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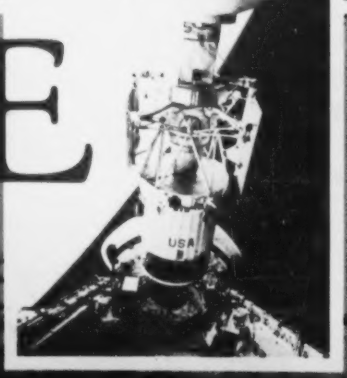
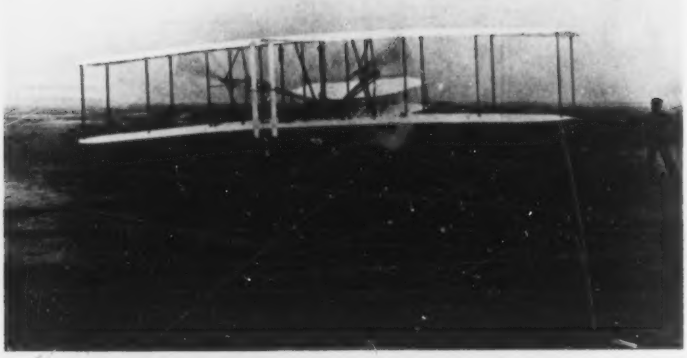
FACTS AND FIGURES

AEROSPACE





ABOUT THE COVER: Centuries of lessons learned . . . and mistaken turns . . . preceded man's first powered flight in a heavier-than-air craft. In less than a century since then, man has been to the moon and begun to explore the vast universe. The United States—"first in flight," thanks to the Wright brothers—has become a world leader in aerospace. For most of that time—for 70 years—U.S. aviation, space and defense efforts have been served by the Aerospace Industries Association.

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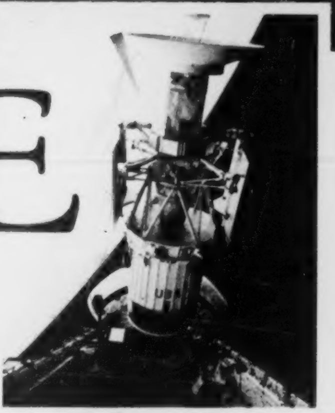
FACTS AND FIGURES

AEROSPACE



70th ANNIVERSARY
1919 · 1989

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On December 17, 1903, the Wright brothers achieved the first power-driven flight in a heavier-than-air craft. However, it wasn't until the outbreak of World War II, more than 10 years later, that the potential of this breakthrough was exploited. The war provided the first real impetus to aircraft production in the United States.

Production figures for those early years are scarce although the U.S. Census first undertook to report on aircraft production in 1914. (Export data had been available since 1912.) Up to 1925, aircraft and engine production data were unreliable for other than trend indications. From 1925 to 1937, production figures were published by the Aeronautical Chamber of Commerce—today, the Aerospace Industries Association. In 1945, the association, then called the Aircraft Industries Association, first published a separate statistical handbook on industry data.

". . . the relative shortness of time in which aviation has assumed major significance has prevented an accumulation of records on which students normally base long-range historical and economic interpretations. Security regulations during the war added to this difficulty. All these factors have contributed to the lack of basic information on the role of air power in our national life.

"Only now is it possible to furnish some of the factual data for objective studies. The new handbook on aviation, of which this volume is the first, should do much to help students of some or all of the questions confronting aviation. To our knowledge this is the first comprehensive survey of aviation statistics."

from *Aviation Facts & Figures*, 1945
first in a series of statistical handbooks
of which this is the 37th edition.

BOEING 767
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Foreword

For the U.S. aerospace industry, 1988 was a "good news, bad news" year.

The good news is that the industry once again posted new records for sales, earnings, orders, backlog, export volume and trade balance.

The bad news, which is not really news but confirmation of a long-expected outcome, lies in statistical evidence of a coming decline in military business. The full impact on industry sales of four consecutive negative growth defense budgets has been delayed because of the long lead times involved in major aerospace systems, but inklings of diminishing defense activity appear in 1988 data.

For example, the industry's sales to the Department of Defense of aerospace products and services declined for the first time since 1974. And although the industry's overall backlog of orders increased monumentally in 1988 — by more than 20 percent — the backlog of orders from the U.S. government actually dipped for the second straight year. The defense budget trend indicates that we can expect substantially reduced sales to the military services at least through the mid-1990s and probably for the remainder of the century.

On a positive note, the industry is gratified at its once-again-outstanding performance in international trade. In a year in which the United States as a whole experienced its 13th consecutive trade deficit, the industry recorded an all-time record level of exports and a new peak trade balance.

This is encouraging evidence of the continuing foreign acceptance of U.S. aerospace products. The aerospace achievement of nearly $27 billion in sales abroad, offsetting to substantial degree U.S. deficits in other areas of international trade, also underlines the importance to the U.S. economy of high value, high technology aerospace exports.

When final data are available for 1989, we expect to see another banner year and probably a new overall sales record. Beyond that, however, the anticipated continuance of the downward trend in defense budgets portends a downturn in the industry's overall sales for at least several years.

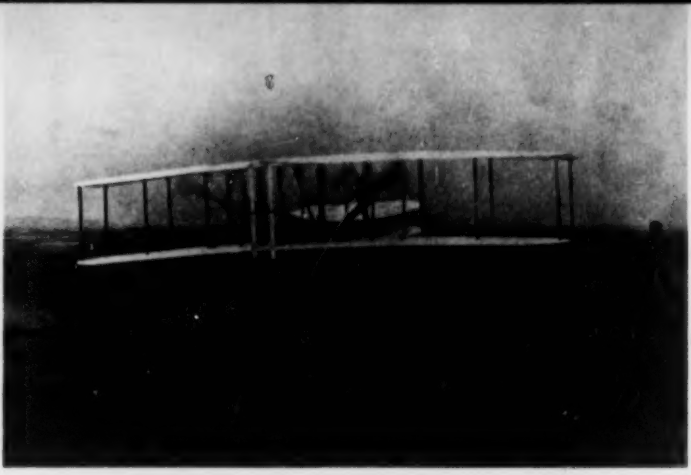
Fortunately, the defense business decline comes at a time when prospects look good in two other major areas of industry activity. The commercial aircraft manufacturing segment of the industry is experiencing a cascade of orders for airline transports and projections suggest a sales level in the 1990s double or more than of the 1980s. Space Station Freedom and other new programs, including some military space projects, bid to expand significantly the industry's space fabrication work load.

AIA feels, therefore, that gains in these areas will offset to considerable degree the indicated reduction in defense business. But not entirely; we see a moderate decline in overall sales for the industry as a whole, probably beginning in 1990.

I am confident, however, that the industry's activity level in the 1990s will be sufficiently healthy to preserve our personnel and technological strengths, so that we will be well positioned to take on the great aerospace challenges envisioned for the 21st century.

With this 37th annual edition, Aerospace Industries Association resumes responsibility for publishing and marketing *Aerospace Facts and Figures* after a productive 20-year association with *Aviation Week & Space Technology*. I trust that the government and industry officials, journalists, analysts, legislators and students who comprise the principal readership of this publication will find the 1989/1990 volume as useful and informative as its predecessors.

Don Fuqua
President
Aerospace Industries Association



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Aerospace Summary

The aerospace industry's total sales in 1988 reached a new all-time high more than four percent above the prior record set in 1987. The industry also posted new record levels of earnings, orders received for aerospace systems, backlog at yearend, export volume and trade balance.

Here is a breakdown of the industry's performance in 1988:

Sales. Total sales amounted to $114.6 billion, according to Aerospace Industries Association data; the figure compares with $110 billion in the previous year.

As is customarily the case, sales of aircraft predominated in a breakdown by product group. Aircraft sales amounted to $60.9 billion, roughly 53 percent of total sales; the comparable figure for 1987 was $59.2 billion. The 1988 total was compounded of a large increase in sales of civil aircraft and a significant decline in sales of military aircraft.

As they have since 1983, sales of space systems ranked second among product categories. Combined civil/military space sales totaled $24.3 billion, up from $22.3 billion in 1987. Sales of missiles increased slightly ($10.3 billion, compared with $10.2 billion in the previous year) and there was also an increase in the "related products and services" grouping, up to $19.1 billion from the previous year's $18.3 billion.

For 1988, aerospace sales represented 2.3 percent of the U.S. Gross National Product and 4.4 percent of total sales by all U.S. manufacturing industries. The comparable figures for the preceding year were 2.4 percent and 4.6 percent, respectively.

Earnings. The industry recorded a net profit after taxes of $4.9 billion, which compares with $4.6 billion in 1987. Among factors contributing to record earnings were the all-time high sales level and an increasing volume of commercial business, which is generally more profitable than government business.

Despite the gain, 1988 aerospace profit rates remained below the averages for all U.S. manufacturing corporations. Expressed as a percentage of sales, the aerospace profit rate was 4.3 percent, compared with the all-industry average of 5.9 percent. As a percentage of assets, the rate was 4.4 percent for aerospace and 6.8 percent for all manufacturing. As a percentage of equity, the aerospace profit amounted to 14.9 percent; the all-industry average was 16.1 percent.

Orders and Backlog. After two years of decline, the flow of new aerospace orders from government agencies rebounded with a two percent increase over the previous year's level, but that is not indicative of a new upward trend; the full effects of several negative growth defense budgets, delayed because of the long lead times associated with major aerospace systems, are expected to renew the declining trend. As reported by the Bureau of the Census, government orders in 1988 totaled $67.9 billion, up from $66.3 billion in 1987. But for the first time since 1980, non-government orders topped U.S. government orders.

Orders from non-government sources surged upward more than 44 percent above the previous year's level. In 1988 they totaled $79.3 billion, compared with $55 billion in 1987. The major component of net new non-government orders was $62.1 billion for aircraft, engines and parts, mostly airline transports and related systems.

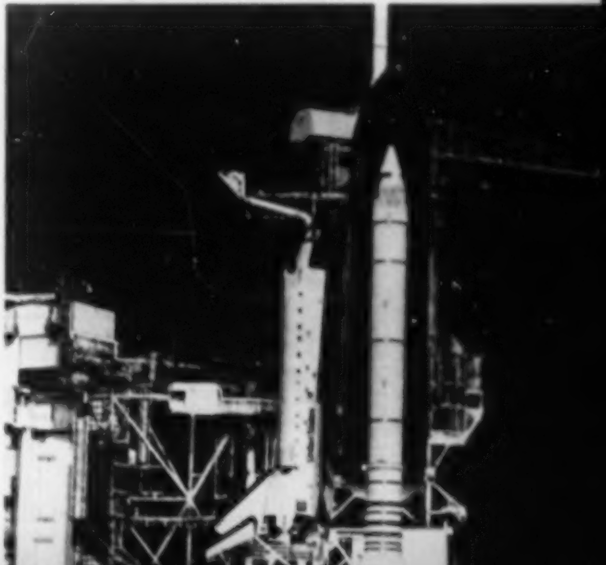
As might be expected with such a heavy flow of new orders, the industry's 1988 backlog not only reached a record level but topped the prior record by more than 20 percent. As of December 31, 1988, backlog was $191.5 billion, up from $158.7 billion at the end of 1987. The 1988 total was compounded of $92.4 billion in U.S. government orders, $99.1 billion in non-government orders. As is customary, the principal element of the backlog was orders for aircraft, engines and parts—$111.3 billion, almost 60 percent of the total.

Civil Aircraft Production. Sharply increased commercial aircraft sales, coupled with a significant rise in general aviation sales, elevated total civil aircraft sales to $15.9 billion, up from $12.1 billion in 1987.

For the third straight year, the industry set a new record for sales of commercial transport aircraft—$13.6 billion, compared with $10.5 billion in 1987 and $10.3 billion in 1986. In numerical terms, the industry delivered 423 transports in 1988, compared with 357 in the previous year. The yearend 1988 backlog for commercial transports included orders for 1,373 aircraft worth $58.5 billion; this compared with 824 planes valued at $32.4 billion at the end of the previous year.

Sales of general aviation planes, at $1.9 billion in 1988, were up more than 40 percent above 1987's $1.4 billion. Numerically, shipments increased from 1,085 in 1987 to 1,143 in 1988.

Civil helicopter sales, in decline for the prior two years, rebounded in 1988. The industry delivered 383 units worth $334 million;



the comparable figures for 1987 were 358 units valued at $277 million.

Military Aircraft Production. The industry produced 1,443 military aircraft in 1988, the highest number produced since 1975 and 244 more than in 1987. The gain in unit terms was due to a major increase in exports of military aircraft; deliveries to U.S. military forces declined.

The 1,443 total included 825 aircraft delivered to U.S. military agencies and 618 exported; the latter number breaks down further into 138 aircraft sold under Foreign Military Sales programs and 480 exported directly from U.S. manufacturers to foreign governments. Sales value data are not available for the exported aircraft; the 825 planes accepted by U.S. military agencies had a combined flyaway value of $16.8 billion, down substantially from the previous year's $21.5 billion.

Department of Defense outlays for aircraft procurement declined significantly in Fiscal Year 1988 to $28.2 billion, down from $33 billion in FY 1987. A slight rebound to $28.8 billion was estimated for FY 89, followed by a resumption for the decline ($26.5 billion) in FY 1990.

Missile Systems. At $10.3 billion, according to Aerospace Industries Association estimates, sales of missile systems were up marginally ($51 million) over 1987. Bureau of the Census data, which exclude propulsion units, show missile sales of $9.5 billion, in rounded-off figures the same as in 1987 but actually $43 million lower.

Census reported that the flow of new orders for missile systems (again excluding propulsion) dropped almost 20 percent to $9.4 billion from 1987's $11.7 billion. Yearend backlog was also down—to $14.3 billion at yearend 1988 from $14.6 billion at the end of the previous year.

Space Programs. The industry's sales of space systems and related equipment, which had risen steadily for more than a decade, reached an all-time peak of $24.3 billion in 1988, up $2 billion over the previous record level of 1987. The major portion of the total was, as has been the case throughout the 1980s, in military sales, although specific calendar year 1988 figures on the military/civil sales ratio are not available.

However, that ratio is shifting as NASA space outlays increase and military space declines in an era of lower defense budgets. This is evidenced by Bureau of the Census data on new orders and backlog. In 1988, orders for spacecraft, space systems and launch vehicle components, exclusive of propulsion units, dropped sharply, to $7.3 billion from the previous year's $11.2 billion. The drop was entirely due to a big reduction in military orders (down more than $4 billion) while non-military orders gained slightly. The industry's space backlog (once again excluding propulsion) also dipped for the same reason (military backlog down, non-military up). The total backlog at yearend 1988 was $10.8 billion, down from $11.8 billion a year earlier.

Research and Development. In 1988, total expenditures for all U.S. industrial research and development activities amounted to $95.8 billion but a decline of more than $3 billion—to $92.6 billion—was expected in 1989, according to a survey by Battelle Memorial Institute. The projected decline is due to reduced government funding of R&D in a time of budgetary austerity. Government funding for 1989 was estimated at $30.8 billion (down from $34.7 billion in 1988); industry funding will amount to $61.9 billion, up from $61.1 billion.

Battelle's projection shows the aerospace industry, perennial leader, as the top R&D performer in 1989 with activities valued at $19.2 billion. The total will include $15.6 billion in federal government funding ($3.5 billion less than in 1988) and $3.5 billion in industry funding (down $1.4 billion).

In second place behind aerospace in the 1989 projection was the electrical machinery and communications group with estimated outlays of $18.5 billion. Next, in order, were machinery ($12.1 billion), chemicals ($11.5 billion) and transportation equipment ($11.4 billion).

Foreign Trade. For the fourth consecutive year, the U.S. aerospace industry posted a new record for export volume, once again underlining the importance to the U.S. economy of high value, high technology exports as aerospace gains offset to some degree a massive overall U.S. trade deficit approaching $130 billion. In 1988, aerospace exports amounted to $26.9 billion, up from $24 billion in 1987; they represented 8.7 percent of the dollar value of all U.S. exports.

However, aerospace imports continued

to increase — to more than $9 billion from the $7.9 billion level of the previous year. Nonetheless, the aerospace trade balance reached a new record — $17.9 billion, up from $16 billion in 1987, also a record.

The composition of the U.S. export volume was roughly three-quarters civil products, one quarter military. Civil exports totaled $20.3 billion, military $6.7 billion. The gain of almost $3 billion over the previous year was largely due to a surge of deliveries of commercial transport aircraft, whose dollar value — $8.8 billion — represented almost a third of all aerospace exports.

Employment. Despite setting sales records in several categories, the aerospace industry's employment curve leveled off in 1988 and the average annual employment for 1988 — 1,313,000 — exactly matched that of the previous year. Aerospace employment accounted for 6.7 percent of the total employment in all U.S. manufacturing industries, down from 6.9 percent in 1987.

The aerospace payroll for 1988 amounted to $34.9 billion, up 2.7 percent over the $34 billion paid in 1987. In 1988, the aerospace payroll represented 6.6 percent of total payroll outlays by all U.S. manufacturing industries.

STANDARD INDUSTRIAL CLASSIFICATIONS APPLICABLE TO THE AEROSPACE INDUSTRY

3721 AIRCRAFT

37211	Complete Aircraft, Military Type
37212	Complete Aircraft, Personal & Utility Type
37213	Complete Aircraft, Commercial Transport Type
37214	Modifications, Conversions, Overhaul of Aircraft
37216	Other Aeronautical Services on Aircraft

3724 AIRCRAFT ENGINES AND ENGINE PARTS

37241	Aircraft Engines for U.S. Military Customers
37242	Aircraft Engines for Other than U.S. Military
37243	Aeronautical Services on Aircraft Engines
37244	Aircraft Engine Parts and Accessories

3728 AIRCRAFT PARTS AND AUXILIARY EQUIPMENT, NEC

37281	Aircraft Parts & Accessories, NEC
37283	Research and Development on Aircraft Parts
37285	Aircraft Propellers and Parts

3761 GUIDED MISSILES AND SPACE VEHICLES

37611	Missile Systems, Excluding Propulsion
37612	Space Vehicle Systems, Excluding Propulsion
37613	Research & Development on Complete Missiles
37614	Research & Development on Complete Space Vehicles
37615	All Other Services on Complete Missiles & Space Vehicles

3764 SPACE PROPULSION UNITS AND PARTS

37645	Complete Missile or Space Vehicle Engines and/or Propulsion Units
37646	Research and Development on Complete Missile or Space Vehicle Engines and/or Propulsion Units
37647	All Other Services on Complete Missile or Space Vehicle Engines and/or Propulsion Units
37648	Missile and Space Vehicle Engine and/or Propulsion Unit Parts and Accessories

3769 SPACE VEHICLE EQUIPMENT, NEC

37692	Missile & Space Vehicle Parts & Subassemblies, NEC
37694	Research & Development on Missile & Space Vehicle Parts & Components, NEC

3663 RADIO AND TELEVISION COMMUNICATION EQUIPMENT

36631	Communication Systems and Equipment, Including Space Satellite Communications Systems
36635	Search & Detection Systems and Navigation and Guidance Systems & Equipment
36639	Electronic Systems and Equipment NEC, including Electronic Trainers and Simulators

3812 SEARCH, DETECTION, NAVIGATION, GUIDANCE, AERONAUTICAL AND NAUTICAL SYSTEMS, INSTRUMENTS AND EQUIPMENT

38121	Aeronautical, Nautical, and Navigational Instrumens, except Aircraft Engine Instruments

3829 MEASURING AND CONTROLLING DEVICES, NEC

38291	Aircraft Engine Instruments except Flight

Source: U.S. Government Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.

NOTE: The Standard Industrial Classification (SIC) is a system developed by the U.S. Government to define the industrial composition of the economy, facilitating comparability of statistics. It is revised periodically to reflect the changing industrial composition of the economy.

NEC: Not elsewhere classified.

AEROSPACE INDUSTRY SALES BY CUSTOMER

Calendar Years 1974-1988
(Millions of Dollars)

Year	TOTAL SALES	Aerospace Products and Services				Related Products and Services
			U.S. Government			
		Total	Dept. of Defense	NASA and Other Agencies	Other Customers	
CURRENT DOLLARS						
1974	$27,454	$23,387	$12,638	$2,608	$ 8,141	$4,067
1975	29,686	24,894	13,125	2,838	8,931	4,792
1976	29,825	24,514	13,403	2,938	8,173	5,311
1977	32,199	26,095	14,368	3,012	8,715	6,104
1978	37,702	30,889	15,533	3,151	12,205	6,813
1979	45,420	37,705	18,918	3,453	15,334	7,715
1980	54,697	45,878	22,795	4,106	18,977	8,819
1981	63,974	53,090	27,244	4,709	21,137	10,884
1982	67,756	56,366	34,016	4,899	17,451	11,390
1983	79,975	66,646	41,558	5,910	19,178	13,329
1984	83,486	69,572	45,969	6,063	17,540	13,914
1985	96,571	80,476	53,178	6,262	21,036	16,095
1986r	106,183	88,486	59,161	6,236	23,089	17,697
1987r	110,008	91,673	61,817	6,813	23,043	18,335
1988	114,562	95,468	61,327	7,899	26,242	19,094
CONSTANT DOLLARS (Aerospace Composite Price Deflator, 1982 = 100)						
1974	$58,165	$49,548	$26,775	$5,525	$17,248	$8,617
1975	56,011	46,970	24,764	5,355	16,851	9,041
1976	51,422	42,265	23,109	5,065	14,091	9,157
1977	51,850	42,021	23,137	4,850	14,034	9,829
1978	57,648	47,231	23,751	4,818	18,662	10,417
1979	62,822	52,151	26,166	4,776	21,209	10,671
1980	68,116	57,133	28,387	5,113	23,633	10,983
1981	70,768	58,728	30,137	5,209	23,382	12,040
1982	67,756	56,366	34,016	4,899	17,451	11,390
1983	76,239	63,533	39,617	5,634	18,282	12,706
1984r	73,491	61,243	40,466	5,337	15,440	12,248
1985r	85,994	71,662	47,354	5,576	18,732	14,332
1986r	92,173	76,811	51,355	5,413	20,043	15,362
1987	NA					
1988	NA					

Source: Aerospace Industries Association.

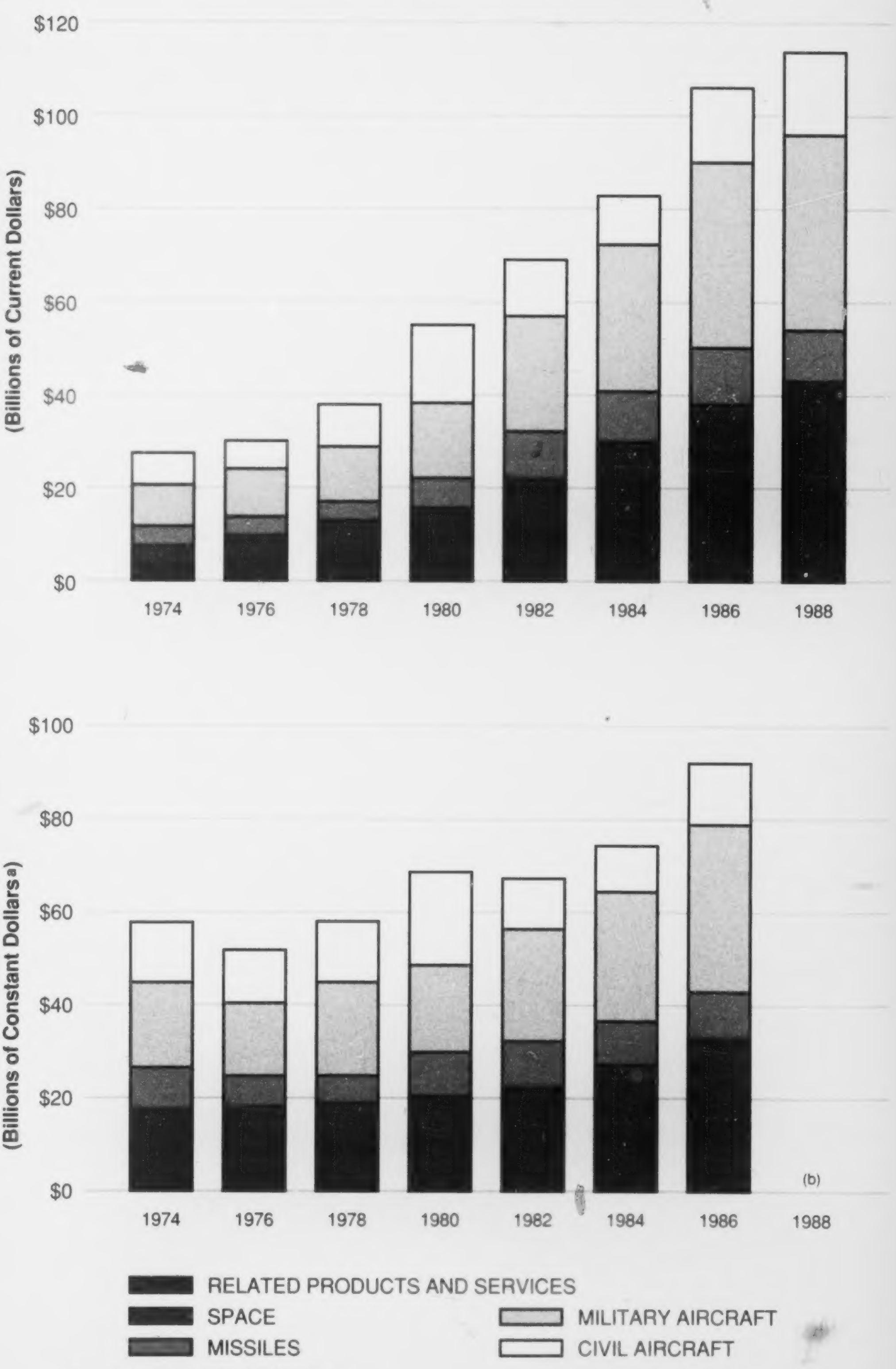
NOTE: See Glossary for explanation of "Aerospace Industry," "Aerospace Sales," "Other Customers," and "Related Products and Services."

A comprehensive revision of the AIA aerospace industry sales series for 1967-1984 was completed in 1985 in order to incorporate different data sources and estimating procedures selected to better reflect the evolving composition of the aerospace industry.

r Revised.

NA Aerospace composite price deflators are no longer available from the Department of Commerce. Work is underway to construct new deflators representative of the industry. Since the 1987 preliminary and 1988 estimated deflators have not been changed since previous publication in Facts & Figures, the deflators shown on page 25 have not been applied to final sales figures for those years.

AEROSPACE SALES BY PRODUCT GROUP



Source: Aerospace Industries Association.

[a] Based on revised aerospace composite price deflator (1982 = 100).

[b] See footnote NA, page 13.

AEROSPACE INDUSTRY SALES BY PRODUCT GROUP

Calendar Years 1974-1988
(Millions of Dollars)

Year	TOTAL SALES	Aircraft			Missiles	Space	Related Products & Services
		Total	Civil	Military			
CURRENT DOLLARS							
1974	$27,454	$14,867	$ 6,320	$ 8,547	$ 4,108	$ 4,412	$ 4,067
1975	29,686	16,433	6,463	9,970	3,775	4,686	4,792
1976	29,825	16,056	6,007	10,049	3,671	4,787	5,311
1977	32,199	16,988	6,183	10,805	4,106	5,001	6,104
1978	37,702	21,074	8,222	12,852	4,098	5,717	6,813
1979	45,420	26,382	13,227	13,155	4,778	6,545	7,715
1980	54,697	31,464	16,285	15,179	6,469	7,945	8,819
1981	63,974	36,062	16,427	19,635	7,640	9,388	10,884
1982	67,756	35,484	10,982	24,502	10,368	10,514	11,390
1983	79,975	42,431	12,373	30,058	10,269	13,946	13,329
1984	83,486	41,905	10,690	31,215	11,335	16,332	13,914
1985	96,571	50,482	13,730	36,752	11,438	18,556	16,095
1986r	106,183	56,405	15,718	40,687	11,964	20,117	17,697
1987r	110,008	59,108	15,465	43,723	10,219	22,266	18,335
1988	114,562	60,886	19,019	41,867	10,270	24,312	19,094
CONSTANT DOLLARS (Aerospace Composite Price Deflator, 1982 = 100)							
1974	$58,165	$31,498	$13,390	$18,108	$ 8,703	$ 9,347	$ 8,617
1975	56,011	31,005	12,194	18,811	7,123	8,842	9,041
1976	51,422	27,683	10,357	17,326	6,329	8,253	9,157
1977	51,850	27,356	9,957	17,399	6,612	8,053	9,829
1978	57,648	32,223	12,572	19,651	6,266	8,742	10,417
1979	62,822	36,490	18,295	18,195	6,609	9,052	10,671
1980	68,116	39,183	20,280	18,903	8,056	9,894	10,983
1981	70,768	39,891	18,171	21,720	8,451	10,385	12,040
1982	67,756	35,484	10,982	24,502	10,368	10,514	11,390
1983	76,239	40,449	11,795	28,654	9,789	13,295	12,706
1984r	73,491	36,888	9,410	27,478	9,978	14,377	12,248
1985r	85,994	44,953	12,226	32,727	10,185	16,524	14,332
1986r	92,173	48,963	13,644	35,319	10,385	17,463	15,362
1987	NA						
1988	NA						

Source: Aerospace Industries Association.

NOTE: See Glossary for explanation of "Aerospace Industry," "Aerospace Sales," and "Related Products & Services." A comprehensive revision of the AIA aerospace industry sales series for 1967-1984 was completed in 1985 in order to incorporate different data sources and estimating procedures selected to better reflect the evolving composition of the aerospace industry.

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SALES OF MAJOR AEROSPACE COMPANIES AS REPORTED BY THE BUREAU OF THE CENSUS

Calendar Years 1974-1988
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, & Parts		Missiles & Space Incl. Propulsion	Other Aerospace		Non-Aerospace
		U.S. Gov't.	Other	U.S. Gov't.	Other		U.S. Gov't.	Other	
CURRENT DOLLARS									
1974	$26,849	$15,196	$11,653	$ 5,982	$ 7,560	$ 5,854	$ 2,101	$1,285	$ 4,067
1975	29,473	17,314	12,159	6,859	7,797	6,310	2,070	1,645	4,792
1976	31,328	19,083	12,245	8,314	7,622	5,880	2,368	1,833	5,311
1977	33,315	20,704	12,611	8,848	7,530	5,775	2,839	2,219	6,104
1978	37,968	21,888	16,080	8,724	10,581	6,380[a]	3,363	2,107[a]	6,813
1979	46,173	23,229	22,944	8,649	16,023	7,197	3,930	2,659	7,715
1980	58,440	26,674	31,766	9,427	20,097	8,393	6,869	2,609	11,045
1981	69,944	33,039	36,905	12,047	21,527	9,722	8,155	3,384	15,109
1982	75,487	42,239	33,248	15,120	16,766	11,980	9,909	4,953	16,759
1983	83,453	49,056	34,397	17,074	18,805	12,745	12,685	2,804	19,340
1984	88,941	55,777	33,164	20,216	17,069	13,624	12,734	2,768	22,530
1985	100,522	63,532	36,990	21,899	22,041	16,741	15,228	2,938	21,675
1986	105,577	65,326	40,251	22,755	25,002	17,535	16,243	3,564	20,478
1987	110,301	68,632	41,669	23,769	25,293	20,715	15,413	3,802	21,309
1988	113,548	68,104	45,444	21,316	29,426	21,514	16,103	3,225	21,964
CONSTANT DOLLARS (1982 = 100)[b]									
1974	$56,883	$32,195	$24,689	$12,674	$16,017	$12,403	$ 4,451	$2,722	$ 8,617
1975	55,609	32,668	22,942	12,942	14,711	11,906	3,906	3,104	9,042
1976	54,014	32,902	21,112	14,334	13,141	10,138	4,083	3,160	9,157
1977	53,647	33,340	20,308	14,248	12,126	9,300	4,572	3,573	9,829
1978	58,055	33,468	24,587	13,339	16,179	9,755	5,142	3,222	10,417
1979	63,863	32,129	31,734	11,963	22,162	9,954	5,436	3,678	10,671
1980	72,777	33,218	39,559	11,740	25,027	10,452	8,554	3,249	13,755
1981	77,372	36,548	40,824	13,326	23,813	10,754	9,021	3,743	16,713
1982	75,487	42,239	33,248	15,120	16,766	11,980	9,909	4,953	16,759
1983	79,555	46,765	32,790	16,276	17,927	12,150	12,092	2,673	18,437
1984[r]	78,293	49,099	29,194	17,796	15,026	11,993	11,209	2,437	19,833
1985[r]	89,512	56,573	32,939	19,500	19,627	14,907	13,560	2,616	19,301
1986[r]	91,647	56,707	34,940	19,753	21,703	15,221	14,100	3,094	17,776
1987	95,577	59,316	36,260	20,832	22,167	17,762	13,589	3,121	18,105
1988					NA				

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

[a] AIA estimate based on M37D data.

[b] Based on revised aerospace composite price deflator; detail may not add to totals because of rounding.

[r] Revised.

NA Aerospace composite deflators are no longer available from the U.S. Department of Commerce. Work is underway to construct new deflators representative of the industry.

ORDERS AND BACKLOG OF MAJOR AEROSPACE COMPANIES AS REPORTED BY THE BUREAU OF THE CENSUS

Calendar Years 1974-1988
(Millions of Current Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, & Parts		Missiles & Space Incl. Propulsion	Other Aerospace		Non-Aerospace
		U.S. Gov't.	Other	U.S. Gov't.	Other		U.S. Gov't.	Other	
NET NEW ORDERS									
1974	$32,704	$19,390	$13,314	$ 7,956	$ 8,612	$ 6,827	$ 2,208	$1,872	$ 5,229
1975	28,995	18,593	10,402	7,821	6,336	6,082	2,127	2,068	4,561
1976	35,992	21,056	14,936	9,513	8,410	5,751	2,431	3,241	6,646
1977	38,922	22,682	16,240	9,369	11,193	6,232	3,554	2,170	6,404
1978	49,819	25,992	23,827	11,150	16,961	7,072[b]	4,631	2,450[b]	7,555
1979[a]	67,561[a]	28,107	37,101	8,762	30,695	7,609	5,184	4,487	8,471
1980	69,624	33,496	36,128	16,555	18,123	9,818	8,528	4,081	12,519
1981	74,922	42,431	32,491	16,946	17,911	12,376	9,350	3,250	15,089
1982[a]	89,168[a]	58,849[a]	30,319[a]	20,547	13,591	13,988	13,643	4,762	20,369
1983	91,647	60,290	31,357	22,171	16,428	14,248	15,209	2,641	20,950
1984	104,863	66,968	37,895	25,829	21,273	16,485	14,050	3,461	23,765
1985	110,968	70,240	40,728	23,751	26,191	20,328	14,466	3,064	23,168
1986	110,836	68,001	42,835	21,642	26,315	20,445	16,439	3,907	22,088
1987	121,224	66,264	54,960	17,019	35,328	26,272	13,899	4,658	24,048
1988	147,128	67,850	79,278	19,611	62,144	20,240	18,174	3,293	23,273
BACKLOG AS OF DECEMBER 31									
1974	$35,516	$20,889	$14,627	$ 9,789	$ 9,602	$ 6,643	$ 1,926	$1,665	$ 5,891
1975	35,038	22,168	12,870	10,751	8,141	6,415	1,983	2,088	5,660
1976	39,702	24,141	15,561	11,950	8,929	6,286	2,046	3,496	6,995
1977	45,309	26,119	19,190	12,471	12,592	6,743	2,761	3,447	7,295
1978	57,160	30,223	26,937	14,897	18,972	7,557	4,029	3,668	8,037
1979[a]	78,548[a]	36,136	42,123	17,316	33,168	7,388	5,613	5,112	9,662
1980	89,732	37,199	52,533	17,435	39,800	8,941	8,421	5,127	10,008
1981	94,710	46,591	48,119	21,292	35,022	11,255	9,052	4,940	13,149
1982[a]	108,391[a]	63,201[a]	45,190[a]	26,644	31,920	13,262	13,268	4,269	16,760
1983	116,585	74,435	42,150	30,688	29,684	14,962	18,489	3,684	19,078
1984	132,507	85,626	46,881	36,312	33,877	17,823	19,684	4,498	20,313
1985	142,953	92,334	50,619	38,150	38,041	21,410	18,677	4,869	21,806
1986	148,212	95,009	53,203	37,044	39,350	24,320	19,133	4,952	23,416
1987	158,650	92,439	66,211	30,323	49,692	30,544	17,888	5,653	24,550
1988	191,518	92,394	99,124	28,412	82,868	29,078	19,822	5,496	25,842

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

[a] 1979 and 1982 Orders and Backlog Totals are final revisions for which product group detail is not available.

[b] AIA estimate based on M37D data.

AEROSPACE SALES AND THE NATIONAL ECONOMY

Calendar Years 1974-1988
(Billions of Dollars)

Year	Gross National Product[c]	Industry Sales			Aerospace Sales As Percent of		
		Manufacturing	Durable Goods	Aerospace	GNP	Manufacturing	Durable Goods
CURRENT DOLLARS							
1974	$1,472.8	$1,017.5	$ 530.8	$27.5	1.9%	2.7%	5.2%
1975	1,598.4	1,039.1	523.9	29.7	1.9	2.9	5.7
1976	1,782.8	1,185.6	608.4	29.8	1.7	2.5	4.9
1977	1,990.5	1,358.4	711.2	32.2	1.6	2.4	4.5
1978	2,249.7	1,522.9	814.2	37.7	1.7	2.5	4.6
1979	2,508.2	1,727.2	912.7	45.4	1.8	2.6	5.0
1980	2,732.0	1,852.7	930.6	54.7	2.0	3.0	5.9
1981	3,052.6	2,017.5	1,006.5	64.0	2.1	3.2	6.4
1982	3,166.0	1,910.3	922.3	67.8	2.1	3.5	7.4
1983[r]	3,405.7	2,045.3	1,019.4	80.0	2.3	3.9	7.8
1984[r]	3,772.2	2,274.9	1,182.0	83.5	2.2	3.7	7.1
1985	4,014.9	2,279.1	1,187.2	96.6	2.4	4.2	8.1
1986	4,240.3	2,273.3	1,201.7	106.2	2.5	4.7	8.8
1987	4,526.7	2,390.0	1,263.5	110.0	2.4	4.6	8.7
1988	4,880.6	2,611.6	1,388.2	114.6	2.3	4.4	8.3

CONSTANT DOLLARS (1982 = 100)[a]

					Real Annual Growth[b]			
					GNP	Mfg.	Durs.	Aero.
1974	$2,727.4	$1,884.3	$ 983.0	$58.2	(0.7)%	6.6%	2.2%	(3.3)%
1975	2,695.4	1,752.3	883.5	56.0	(1.2)	(7.0)	(10.1)	(3.8)
1976	2,825.4	1,878.9	964.2	51.4	4.8	7.2	9.1	(8.2)
1977	2,957.7	2,018.4	1,056.8	51.9	4.7	7.4	9.6	1.0
1978	3,115.9	2,109.3	1,127.7	57.6	5.3	4.5	6.7	11.0
1979	3,191.1	2,197.5	1,161.2	62.8	2.4	4.2	3.0	9.0
1980	3,187.9	2,161.8	1,085.9	68.1	(0.1)	(1.6)	(6.5)	8.4
1981	3,247.4	2,146.3	1,070.7	70.8	1.9	(0.7)	(1.4)	4.0
1982	3,166.0	1,910.3	922.3	67.8	(2.5)	(11.0)	(13.9)	(4.2)
1983[r]	3,277.9	1,968.5	981.1	76.2	3.5	3.0	6.4	12.4
1984[r]	3,502.5	2,112.3	1,097.5	73.5	6.9	7.3	11.9	(3.5)
1985	3,620.3	2,055.1	1,070.5	86.0	3.4	(2.7)	(2.5)	17.0
1986	3,722.8	1,995.9	1,055.0	92.2	2.8	(2.9)	(1.4)	7.2
1987	3,846.0	2,030.6	1,073.5	NA	3.3	1.7	1.8	4.6
1988	4,013.7	2,147.7	1,141.6	NA	4.4	5.8	6.3	0.6

Source: Gross National Product and GNP Implicit Price Deflator: "Economic Report of the President" (Annually) and "Survey of Current Business" (Monthly). Sales of Manufacturing and Durable Goods Industries: "Survey of Current Business" (Monthly). Aerospace Sales: Aerospace Industries Association.

NOTE: See Glossary for explanation of "Aerospace Sales."

[a] Based on aerospace composite price deflator for aerospace industry sales, and GNP implicit price deflator for other series. Aerospace composite price deflators are no longer available from the U.S. Department of Commerce. Work is underway to construct new deflators representative of the industry.

[b] Parentheses indicate negative real annual growth.

[c] Calendar year GNP figures have been changed to reflect revisions to the National Income and Product Accounts (NIPA).

[r] Revised.

NA Not available.

GROSS NATIONAL PRODUCT, FEDERAL BUDGET AND DEFENSE BUDGET

Fiscal Years 1955 - 1990
(Billions of Dollars)

Year	Fiscal Year GNP	Federal Budget Outlays		Defense Outlays as Percent of	
		Net Total[a]	Defense[b]	GNP	Federal Budget
1955	$ 386.4	$ 68.4	$ 42.7	11.1%	62.4%
1956	418.1	70.6	42.5	10.2	60.2
1957	440.5	76.6	45.4	10.3	59.3
1958	450.2	82.4	46.8	10.4	56.8
1959	481.5	92.1	49.0	10.2	53.2
1960	506.7	92.2	48.1	9.5	52.2
1961	518.2	97.7	49.6	9.6	50.8
1962	557.7	106.8	52.3	9.4	49.0
1963	587.8	111.3	53.4	9.1	48.0
1964	629.2	118.5	54.8	8.7	46.2
1965	672.6	118.2	50.6	7.5	42.8
1966	739.0	134.5	58.1	7.9	43.2
1967	794.6	157.5	71.4	9.0	45.3
1968	849.4	178.1	81.9	9.6	46.0
1969	929.5	183.6	82.5	8.9	44.9
1970	990.2	195.6	81.7	8.3	41.8
1971	1,055.9	210.2	78.9	7.5	37.5
1972	1,153.1	230.7	79.2	6.9	34.3
1973	1,281.4	245.7	76.7	6.0	31.2
1974	1,416.5	269.4	79.3	5.6	29.4
1975	1,522.5	332.3	86.5	5.7	26.0
1976	1,698.2	371.8	89.6	5.3	24.1
1977	1,933.0	409.2	97.2	5.0	23.8
1978	2,171.8	458.7	104.5	4.8	22.8
1979	2,447.8	503.5	116.3	4.7	23.1
1980	2,670.6	590.9	134.0	5.0	22.7
1981	2,986.4	678.2	157.5	5.3	23.2
1982	3,139.1	745.7	185.3	5.9	24.8
1983	3,321.9	808.3	209.9	6.3	26.0
1984[r]	3,687.7	851.8	227.4	6.2	26.7
1985[r]	3,952.4	946.3	252.7	6.4	26.7
1986[r]	4,186.8	990.3	273.4	6.5	27.6
1987[r]	4,433.8	1,003.8	282.0	6.4	28.1
1988	4,780.0	1,064.0	290.4	6.1	27.3
1989[E]	5,128.6	1,137.0	298.3	5.8	26.2
1990[E]	5,483.4	1,151.8	303.0	5.5	26.3

Source: "The Budget of the United States Government" (Annually) and Office of Management and Budget, "Federal Government Finances" (Annually)

[a] "Net Total" is government-wide total less intragovernmental transactions.

[b] "Defense" includes the military budget of DOD and other defense-related activities. Beginning in FY 1985, the Federal Budget reflects establishment of a military retirement trust fund. Defense budget data for prior years adjusted for comparable treatment of military retired pay.

[E] Estimate.

FEDERAL OUTLAYS
DEFENSE, NASA AND AEROSPACE PRODUCTS AND SERVICES

Fiscal Years 1962 - 1990
(Millions of Dollars)

Year	TOTAL National Defense	NASA	Federal Outlays for Aerospace Products & Services			Aerospace as Percent of Total National Defense and NASA
			TOTAL	DOD[a]	NASA	
1962	$52,345	$1,257	$11,244	$10,101	$1,143	21.0%
1963	53,400	2,552	12,453	10,126	2,327	22.3
1964	54,757	4,171	13,363	9,630	3,733	22.7
1965	50,620	5,093	11,858	7,296	4,561	21.3
1966	58,111	5,933	14,064	8,704	5,360	22.0
1967	71,417	5,426	15,478	10,341	5,137	20.1
1968	81,926	4,724	16,279	11,681	4,598	18.8
1969	82,497	4,251	15,871	11,686	4,185	18.3
1970	81,692	3,753	14,559	10,860	3,699	17.0
1971	78,872	3,382	13,109	9,771	3,338	15.9
1972	79,174	3,422	12,308	8,936	3,372	14.9
1973	76,681	3,315	11,359	8,089	3,270	14.2
1974	79,347	3,256	11,168	7,987	3,181	13.5
1975	86,509	3,266	11,554	8,373	3,181	12.9
1976	89,619	3,669	12,364	8,816	3,548	13.3
Tr.Qtr.	22,269	952	2,855	1,959	926	12.3
1977	97,241	3,945	13,229	9,389	3,840	13.1
1978	104,495	3,983	13,926	10,067	3,859	12.8
1979	116,342	4,196	16,686	12,622	4,064	13.8
1980	133,995	4,852	20,270	15,558	4,712	14.6
1981	157,513	5,426	24,280	19,002	5,278	14.9
1982	185,309	6,035	29,501	23,575	5,926	15.4
1983	209,903	6,664	35,364	28,808	6,556	16.3
1984	227,413	7,048	39,662	32,723	6,939	16.9
1985	252,748	7,251	44,416	37,335	7,081	17.1
1986	273,375	7,403	49,773	42,558	7,215	17.7
1987[r]	281,999	7,591	51,871	44,429	7,442	17.9
1988	290,361	9,091	48,848	39,922	8,926	16.3
1989[E]	298,255	10,596	52,548	42,121	10,427	17.0
1990[E]	302,991	12,597	52,628	40,268	12,360	16.7

Source: The Budget of the United States Government" (Annually).

NOTE: "National Defense" includes the military budget of the Department of Defense and other defense-re "TOTAL NASA" includes all categories of the NASA budget, NASA construction not included in "Aeros and services." See additional explanation with following table.

[a] Outlays for aircraft and missile procurement. Does not include RDT&E, which DOD has not reported by product group since 1977, and which, for comparability, has been subtracted from data previously reported earlier years. Also included are revisions to missile procurement data.

[E] Estimate. Latest year reflects Administration's budget proposal.

[r] Revised.

FEDERAL OUTLAYS FOR AEROSPACE PRODUCTS AND SERVICES

Fiscal Years 1962 - 1990
(Millions of Dollars)

Year	TOTAL	Department of Defense[a]			NASA[b]
		TOTAL	Aircraft	Missiles[c]	
1962	$11,244	$10,101	$6,659	$3,442	$1,143
1963	12,453	10,126	6,309	3,817	2,327
1964	13,363	9,630	6,053	3,577	3,733
1965	11,858	7,296	5,200	2,096	4,562
1966	14,064	8,704	6,635	2,069	5,360
1967	15,478	10,341	8,411	1,930	5,137
1968	16,279	11,681	9,462	2,219	4,598
1969	15,871	11,686	9,177	2,509	4,185
1970	14,559	10,860	7,948	2,912	3,699
1971	13,109	9,771	6,631	3,140	3,338
1972	12,308	8,936	5,927	3,009	3,372
1973	11,359	8,089	5,066	3,023	3,270
1974	11,168	7,987	5,006	2,981	3,181
1975	11,554	8,373	5,484	2,889	3,181
1976	12,364	8,816	6,520	2,296	3,548
Tr. Qtr.	2,885	1,959	1,557	402	926
1977	13,229	9,389	6,608	2,781	3,840
1978	13,926	10,067	6,971	3,096	3,859
1979	16,686	12,622	8,836	3,786	4,064
1980	20,270	15,558	11,124	4,434	4,712
1981	24,280	19,002	13,193	5,809	5,278
1982	29,501	23,575	16,793	6,782	5,926
1983	35,364	28,808	21,013	7,795	6,556
1984	39,662	32,723	23,196	9,527	6,939
1985	44,416	37,335	26,586	10,749	7,081
1986	49,773	42,558	30,828	11,730	7,215
1987[r]	51,871	44,429	32,956	11,473	7,442
1988	48,848	39,922	28,246	11,676	8,926
1989[E]	52,548	42,121	28,751	13,370	10,427
1990[E]	52,628	40,268	26,511	13,757	12,360

Source: Department of Defense Budget (Annually); NASA Budget (Annually).

[a] Outlays for aircraft and missile procurement. Does not include RDT&E, which DOD has not reported by product group since 1977, and which, for comparability, has been subtracted from data previously reported in this table for earlier years.

[b] Includes Research & Development, and Research & Program Management, and, effective with 1984 data, Space Flight, Control and Data Communications; excludes Construction of Facilities.

[c] 1978 and subsequent years revised by AIA from previously published data to include Navy Weapons Procurement in Missiles Procurement. Beginning 1978, DOD combined Navy Missile Procurement with torpedoes and other related products into Navy Weapons Procurement, of which missiles comprise approximately 80 percent.

[E] Estimate. Latest year reflects Administration's budget proposal.

[r] Revised.

DEPARTMENT OF DEFENSE
TOTAL MILITARY OUTLAYS BY FUNCTIONAL TITLE[a]

Fiscal Years 1981–1990
(Millions of Dollars)

	1981	1982	1983
TOTAL[d]	$153,868[r]	$180,714[r]	$204,410[r]
Procurement-TOTAL	35,191	43,271	53,624
Aircraft	13,193	16,793	21,013
Missiles[b]	5,809	6,782	7,795
Ships	5,218	6,739	7,504
Weapons[b]	1,848	2,144	3,420
Ammo	1,368	1,647	1,966
Communications & Electronics[c]	2,399	2,733	
Other	5,355	6,433	11,926
Military Personnel-TOTAL	47,941	55,170	60,886
Active Forces	33,378	38,522	41,015
Reserve Forces	3,031	3,818	4,508
Retired Pay	13,729	14,938	15,945
Adjustment: Retirement Trust Fund Accrual[d]	(2,197)	(2,109)	(583)
Research, Development, Test, & Evaluation	15,278	17,729	20,554
Operations & Maintenance	51,885	59,695	64,932
Military Construction	2,458	2,922	3,524
Family Housing	1,721	1,993	2,126
Other	(605)	(65)	(1,236)

Source: Department of Defense Budget (Annually) and "Status of Funds" (Annual Summaries).

NOTE: Data in parentheses are credit items. Detail may not add to totals because of rounding.

[a] Includes all items in the DOD military budget; excludes the DOD civil budget for the Army Corps of Engineers and other non-defense related activities.

[b] Beginning in 1978, DOD combined Navy Missiles Procurement with torpedoes and other related products into Navy Weapons Procurement. Missiles comprise approximately 80 percent of the value of this category.

[c] Not available as separate item after 1982; included in Other Procurement.

[d] Beginning in FY 1985, the Federal Budget reflects establishment of a military retirement trust fund. Data for previous years have been adjusted on a comparable basis.

[E] Estimate. Latest year reflects Administration's budget proposal.

[r] Revised.

DEPARTMENT OF DEFENSE
TOTAL MILITARY OUTLAYS BY FUNCTIONAL TITLE[a] (Continued)

Fiscal Years 1981–1990
(Millions of Dollars)

1984	1985	1986	1987	1988	1989[E]	1990[E]
$220,928[r]	$245,154[r]	$265,480[r]	$273,966[r]	$281,935	$289,800	$293,821
61,879	70,381	76,517	80,744	77,166	80,651	78,711
23,196	26,586	30,828	32,956	28,246	28,751	26,511
9,527	10,749	11,730	11,473	11,676	13,370	13,757
8,487	9,145	9,501	9,316	8,878	10,540	10,675
3,691	3,801	4,343	4,962	4,727	4,120	3,965
1,826	2,080	1,933	2,111	2,250	2,079	1,969
} 15,152	} 18,020	} 18,182	} 19,926	} 21,389	} 21,632	} 21,835
64,158	67,842	71,511	72,020	76,337	78,229	79,377
42,732	60,344	63,139	63,810	67,642	69,199	70,368
4,923	7,498	8,373	8,210	8,694	9,031	9,009
16,503	(d)	(d)	(d)	(d)	(d)	(d)
(2)	—	—	—	—	—	—
23,117	27,103	32,283	33,596	34,792	37,023	38,700
67,388	72,371	75,288	76,205	84,475	85,394	88,673
3,706	4,260	5,067	5,853	5,874	5,751	5,361
2,413	2,642	2,819	2,908	3,082	3,215	3,353
(1,732)	553	1,995	2,709	208	(463)	(355)

FEDERAL PRICE DEFLATORS FOR GNP, DEFENSE, PPI AND CPI

(1961–1990)

Year	GNP		Federal Defense Durables (FY 1982 = 100)	Gov't Purchases Goods & Services (CY 1982 = 100)	PPI Capital Equip. (CY 1982) = 100)	CPI (Urban) All Items (CY 1982 = 100)[r]
	FY GNP (FY 1982 = 100)	CY GNP (CY 1982 = 100)				
1961	31.44	31.2	32.96	NA	32.9	29.9
1962	32.00	31.9	33.54	NA	33.0	30.2
1963	32.58	32.4	34.65	NA	33.1	30.6
1964	33.05	32.9	34.67	NA	33.4	31.0
1965	33.76	33.8	35.24	NA	33.8	31.5
1966	34.74	35.0	36.12	NA	34.6	32.4
1967	35.93	35.9	37.67	NA	35.8	33.4
1968	37.19	37.7	39.07	NA	37.0	34.8
1969	39.20	39.8	40.50	NA	38.3	36.7
1970	41.48	42.0	42.26	NA	40.1	38.8
1971	43.66	44.4	44.54	NA	41.7	40.5
1972	46.06	46.5	46.58	41.8	42.8	41.8
1973	48.35	49.5	48.71	45.3	44.2	44.4
1974	52.16	54.0	51.32	50.6	50.5	49.3
1975	57.52	59.3	56.34	55.6	58.2	53.8
1976	62.08	63.1	59.80	59.3	62.1	56.9
1977	67.03	67.3	63.89	63.4	66.1	60.6
1978	71.72	72.2	67.66	67.8	71.3	65.2
1979	77.90	78.6	73.86	74.2	77.5	72.6
1980	84.74	85.7	82.02	83.4	85.8	82.4
1981	93.22	94.0	91.36	92.9	94.6	90.9
1982	100.00	100.0	100.00	100.0	100.0	96.5
1983	104.23	103.9	104.04	103.6	102.8	99.6
1984	108.19	107.7	107.94	107.2	105.2	103.9
1985	111.53	110.9	107.89	109.2	107.5	107.6
1986	114.58	113.9	109.58	110.4	109.7	109.6
1987	118.24	117.7	106.23	111.5	111.7	113.6
1988[p]	121.96	121.6	102.67	114.3	114.3	118.3
1989[E]	126.82	126.4	106.76	NA	NA	NA
1990[E]	131.43	130.9	110.54	NA	NA	NA

Source: GNP and Defense Purchases from U.S. Department of Commerce, Bureau of Economic Analysis; PPI-Capital Equipment Deflator and CPI Deflator from U.S. Department of Labor Statistics. Estimates from Economic Assumptions of the Budget of the United States Government (latest year).

p Preliminary.
r Revised.
E Estimate.
NA Not Available

Key:
CY = Calendar Year.
FY = Fiscal Year
GNP = Gross National Product.
PPI = Producer Price Index for Capital Equipment.
CPI = Consumer Price Index (for all items), for All Urban Consumers for 1978 and subsequent years, and for All Urban Wage Earners for prior years.

FEDERAL PRICE DEFLATORS FOR AEROSPACE INDUSTRY

Calendar Years 1964-1988

Year	Aerospace Deflators (CY 1982 = 100)[a]						
	Composite	SIC 3721	SIC 3724	SIC 3728	SIC 3761	SIC 3764	SIC 3769
1964	29.8	30.7	27.5	31.3	30.1	27.2	27.4
1965	30.3	31.4	27.8	31.9	30.5	27.4	28.3
1966	31.2	35.7	28.5	32.8	31.9	28.1	29.2
1967	32.3	33.1	29.3	33.6	33.4	29.0	30.1
1968	33.3	34.2	29.9	34.5	34.8	29.5	31.0
1969	34.6	35.6	31.3	35.6	36.1	30.9	32.4
1970	36.6	37.7	32.9	37.4	38.1	32.5	34.2
1971	38.0	39.3	34.2	38.8	39.7	33.7	35.7
1972	38.4	44.5	35.3	43.4	42.5	35.4	38.1
1973	42.9	45.9	36.3	45.2	42.2	36.6	39.5
1974	47.2	49.9	41.0	52.2	44.5	41.7	44.0
1975	53.0	53.8	49.6	61.2	48.4	50.6	52.2
1976	58.0	58.8	53.9	67.0	53.9	55.4	56.7
1977	62.1	62.6	57.6	69.6	59.5	59.9	61.4
1978	65.4	66.1	64.1	65.5	65.0	65.4	66.1
1979	72.3	72.8	71.5	69.9	74.6	72.0	72.7
1980	80.3	81.2	77.8	77.4	84.4	80.8	80.9
1981	90.4	90.0	90.4	88.8	93.2	92.1	89.5
1982	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1983	104.9	105.2	105.0	104.2	105.5	104.4	102.8
1984[r]	113.6	118.0	115.1	111.0	107.8	105.9	110.8
1985[r]	112.3	112.2	116.4	112.0	109.6	106.2	116.5
1986	115.2	118.5	116.5	116.1	108.6	107.6	116.9
1987[p]	114.1	109.2	117.3	118.5	116.0	109.3	125.2
1988[E]	118.2	113.5	121.9	122.5	119.5	112.6	128.9

Source: U.S. Department of Commerce, Bureau of Economic Analysis and International Trade Administration.

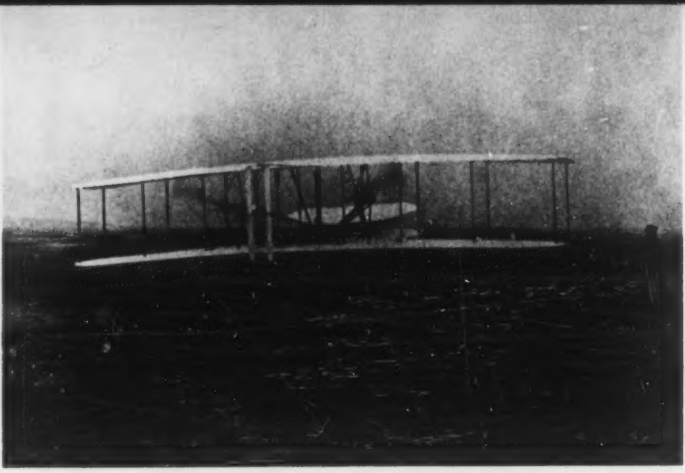
[a] Reported by Dept. of Commerce with 1982 base year; years prior to 1972 converted to 1982 base year for comparability. 1987 preliminary and 1988 estimated deflators have not been changed since previous publication in *Facts & Figures*. Aerospace composite price deflators are no longer available from the Department of Commerce. Work is underway to construct new deflators representative of the industry.

[p] Preliminary

[r] Revised.

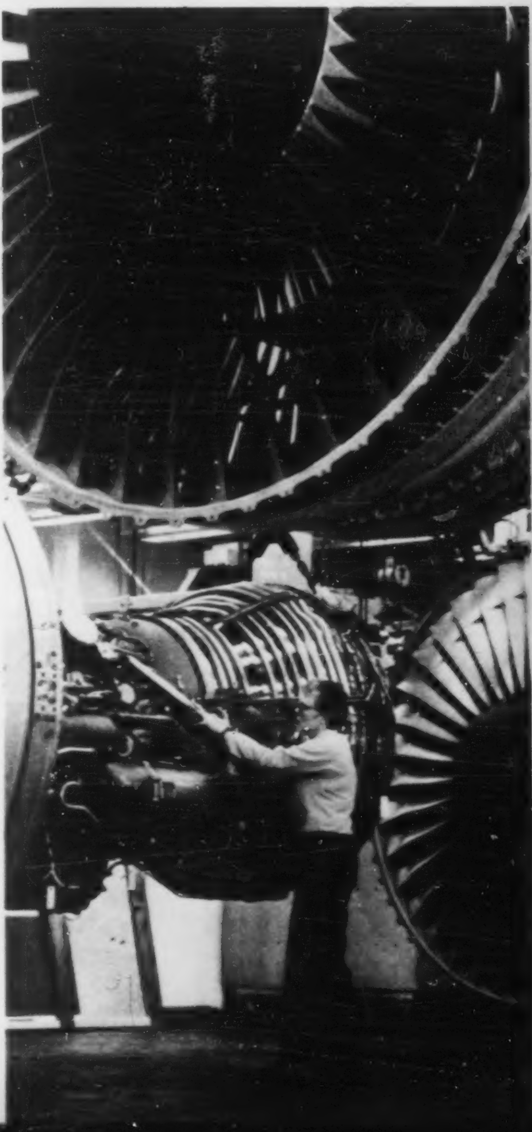
[E] Estimate.

Key: SIC = Standard Industrial Classification. SIC 3721 = Aircraft; SIC 3724 = Aircraft Engines and Engine Parts; SIC 3728 = Aircraft Parts; SIC 3761 = Missiles and Space Vehicles; SIC 3764 = Space Propulsion; SIC 3769 = Space Equipment not elsewhere classified. Aerospace Composite aggregated by weighting individual SIC categories according to constant dollar value of industry shipments.



89 90

Aircraft Production



A big jump in sales of commercial transports plus an upturn in general aviation sales combined to elevate 1988 sales of aircraft, engines and parts to an all-time high, despite a significant decline in the dollar value of military aircraft sales.

Total sales amounted to $50.7 billion, up from $49 billion in the previous year.

Numerically, U.S. aircraft production—as measured by deliveries in 1988—increased over 1987. The industry produced 3,392 aircraft of all types, 1,949 of them civil aircraft and 1,443 military. The comparable figures for 1987 were 2,999 total, 1,800 civil, 1,199 military.

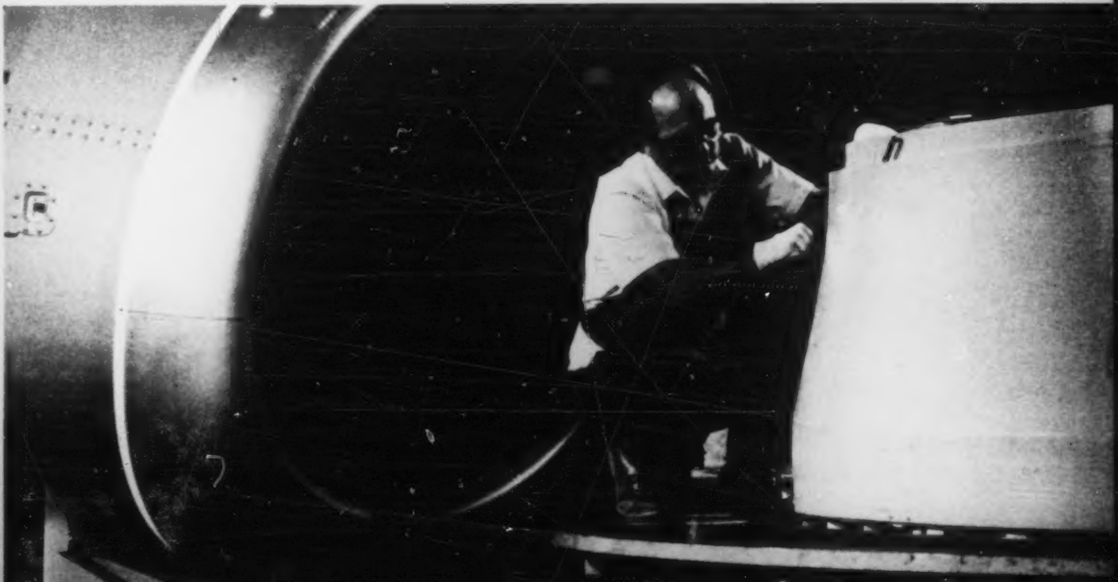
In 1988, the aerospace industry experienced a great surge of new orders for aircraft, by far the largest total dollar value in the industry's history—$82.1 billion, some 57 percent higher than the $52.3 billion recorded in 1987, which was the previous record year. Despite declining defense budgets in Fiscal Year 1988 and two prior years, orders from the U.S. government—principally military aircraft—increased to $19.6 billion from the previous year's $17 billion. Non-government orders, principally orders from U.S. and foreign airlines for civil transports, increased by an astonishing 77 percent to a 1988 level of $62.5 billion.

Total backlog of orders, as of yearend 1988, similarly reached a record level of $111.3 billion, up from $80 billion at the end of 1987. The composition of the backlog was $28.4 billion in government orders (down from $30.3 billion) and $82.9 billion in non-government orders (up from $49.7 billion).

Among other 1988 aircraft production highlights:

- Sales of commercial transports, which have been at record levels since 1986, zoomed to a new high of $13.6 billion, which compares with $10.5 billion in 1987. In terms of numbers, the industry delivered 423 transports, up from 357 in the previous year. The yearend backlog for civil transports climbed to $58.5 billion from 1987's $32.4 billion; numerically, there were 1,373 aircraft on order, compared with 824 at the end of 1987. Some $39.5 billion (840 aircraft) was in orders from foreign customers, indicating continuing high levels of export sales into the mid-1990s.
- Sales of general aviation aircraft increased significantly in 1988. In terms of dollar value, sales amounted to $1.9 billion, up more than 40 percent over the 1987 figure of $1.4 billion. Numerically, deliveries totaled 1,143, up from 1,085 in the previous year.
- Sales of civil helicopters rebounded from 1987's 10-year low of $277 million to $334 million in 1988; the number of units also increased, from 358 to 383.
- In unit terms, almost 60 percent of all civil aircraft produced were delivered to foreign customers; 1,140 of the 1,949 aircraft built went abroad. General aviation exports numbered 643 planes (to 500 sold domestically); transports, 217 exported, 206 delivered in the U.S.; helicopters 280 shipped abroad, 103 domestic sales.
- The 1,443 military aircraft produced represent the highest number since 1975. However, this is not indicative of a new trend; military aircraft sales are expected to decline substantially in the 1990s, as is evidenced in Department of Defense procurement estimates. DoD reported procurement outlays of $28.2 billion in Fiscal Year 1988, down from $33 billion in FY 1987. DoD estimated outlays of $28.8 in FY 1989 and $26.5 billion in FY 1990.
- The total of 1,443 military aircraft included 825 delivered to the U.S. military agencies and 618 exported; the latter number included 138 aircraft sold under Foreign Military Sales programs and 480 exported directly from U.S. manufacturers to foreign governments.

The 825 aircraft accepted by the U.S. military agencies was 33 fewer than in the previous year; total flyaway value in 1988 was $16.8 billion, compared with $21.5 billion in 1987. Fighter aircraft (498 units in 1988) accounted for most of the deliveries and more than half of the dollar value ($8.8 billion).



SALES OF AIRCRAFT, ENGINES, AND PARTS

Calendar Years 1974-1988
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Complete Aircraft & Parts		Aircraft Engines & Parts	
		U.S. Gov't.	Other	U.S. Gov't.	Other	U.S. Gov't.	Other
CURRENT DOLLARS							
1974	$13,542	$ 5,982	$ 7,560	$ 4,562	$ 5,846	$1,420	$1,714
1975	14,656	6,859	7,797	5,269	6,001	1,590	1,796
1976	15,936	8,314	7,622	6,336	5,900	1,978	1,722
1977	16,378	8,848	7,530	6,855	5,670	1,993	1,860
1978	19,305	8,724	10,581	6,853	7,873	1,871	2,708
1979	24,672	8,649	16,023	6,378	12,701	2,271	3,322
1980	29,524	9,427	20,097	6,724	15,901	2,703	4,196
1981	33,574	12,047	21,527	8,197	16,877	3,850	4,650
1982	31,886	15,120	16,766	10,903	12,316	4,217	4,450
1983	35,879	17,074	18,805	12,898	14,419	4,176	4,386
1984	37,285	20,216	17,069	15,136	13,121	5,080	3,948
1985	43,940	21,899	22,041	17,783	16,466	4,116	5,575
1986	47,757	22,755	25,002	18,788	19,177	3,967	5,825
1987	49,062	23,769	25,293	18,131	18,899	5,638	6,394
1988	50,742	21,316	29,426	15,278	20,433	6,038	8,993
CONSTANT DOLLARS (1982 = 100)^{a}							
1974	$28,691	$12,674	$16,017	$ 9,665	$12,386	$3,008	$3,631
1975	27,653	12,942	14,711	9,942	11,323	3,000	3,389
1976	27,476	14,334	13,141	10,924	10,172	3,410	2,969
1977	26,374	14,248	12,126	11,039	9,130	3,209	2,995
1978	29,518	13,339	16,179	10,479	12,038	2,861	4,141
1979	34,124	11,963	22,162	8,822	17,567	3,141	4,595
1980	36,767	11,740	25,027	8,374	19,802	3,366	5,225
1981	37,139	13,326	23,813	9,067	18,669	4,259	5,144
1982	31,886	15,120	16,766	10,903	12,316	4,217	4,450
1983	34,203	16,276	17,927	12,296	13,745	3,981	4,181
1984^{r}	32,821	17,796	15,026	13,324	11,550	4,472	3,475
1985^{r}	39,127	19,500	19,627	15,835	14,663	3,665	4,964
1986^{r}	41,456	19,753	21,703	16,309	16,647	3,444	5,056
1987	42,999	20,832	22,167	15,890	16,564	4,941	5,604
1988				NA			

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

[a] Based on revised aerospace composite price deflator; detail may not add to totals because of rounding.

[r] Revised.

NA Aerospace composite deflators are no longer available from the U.S. Department of Commerce. Work is underway to construct new deflators representative of the industry.

ORDERS AND BACKLOG OF AIRCRAFT, ENGINES, AND PARTS

Calendar Years, 1974-1988
(Millions of Current Dollars)

Year	GRAND TOTAL	TOTAL		Complete Aircraft & Parts		Aircraft Engines & Parts	
		U.S. Gov't.	Other	U.S. Gov't.	Other	U.S. Gov't.	Other
NET NEW ORDERS							
1974	$16,568	$ 7,956	$ 8,612	$ 5,948	$ 6,467[a]	$2,008	$ 2,145[a]
1975	14,157	7,821	6,336	6,314	4,758[a]	1,507	1,578[a]
1976	17,923	9,513	8,410	7,498	6,316[a]	2,015	2,094[a]
1977	20,562	9,369	11,193	6,507	8,406	2,862	2,787
1978	28,111	11,150	16,961	9,055	14,229	2,095	2,732
1979	39,457	8,762	30,695	8,762	25,084[a]	2,348	5,611[a]
1980	34,678	16,555	18,123	11,606	14,427	4,949	3,696
1981	34,857	16,946	17,911	11,760	12,621	5,186	5,290
1982	34,138	20,547	13,591	15,978	10,540	4,569	3,051
1983	38,599	22,171	16,428	17,402	11,688	4,769	4,740
1984	47,240	25,829	21,411	19,228	18,286	6,601	3,125
1985	49,942	23,751	26,191	20,062	20,153	3,689	6,038
1986	47,957	21,642	26,315	17,361	20,083	4,281	6,232
1987	52,347	17,019	35,328	12,742	26,411	4,277	8,917
1988	82,148	19,611	62,537	12,862	46,393	6,749	16,144
BACKLOG AS OF DECEMBER 31							
1974	$19,391	$ 9,789	$ 9,602	$ 7,698	$ 7,791	$2,091	$1,811
1975	18,892	10,751	8,141	8,743	6,646	2,008	1,495
1976	20,879	11,950	8,929	9,905	7,416	2,045	1,513
1977	25,063	12,471	12,592	9,557	10,152	2,914	2,440
1978	33,869	14,897	18,972	11,759	16,508	3,138	2,464
1979	50,484	17,316	33,168	13,331	27,955	3,985	5,213
1980	57,235	17,435	39,800	12,702	33,258	4,733	6,542
1981	56,314	21,292	35,022	15,626	27,683	5,666	7,339
1982	58,564	26,644	31,920	20,626	25,980	6,018	5,940
1983	60,372	30,688	29,684	24,091	23,377	6,597	6,307
1984	70,327	36,312	34,015	28,183	28,542	8,129	5,473
1985	76,191	38,150	38,041	30,462	32,091	7,688	5,950
1986	76,391	37,041	39,350	29,035	32,997	8,006	6,353
1987	80,015	30,323	49,692	23,645	40,849	6,678	8,843
1988	111,280	28,412	82,868	21,083	66,782	7,329	16,086

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

[a] AIA estimate, based on MQ37D data.

U.S. AIRCRAFT PRODUCTION—CIVIL

Calendar Years 1969-1988

Year	TOTAL	Domestic Shipments			Export Shipments		
		Transports[a]	Helicopters	General Aviation	Transports	Helicopters	General Aviation
1969	13,505	332	282	9,996	182	252	2,461
1970	8,076	127	150	5,246	184	332	2,037
1971	8,158	50	171	5,900	173	298	1,566
1972	10,576	79	319	7,702	148	256	2,072
1973	14,709	143	342	10,482	151	428	3,163
1974	15,326	91	433	9,903	241	395	4,263
1975	15,251	127	528	10,804	188	336	3,268
1976	16,429	64	442	12,232	158	315	3,218
1977	17,913	54	527	13,441	101	321	3,469
1978	18,962	130	536	14,346	111	368	3,471
1979	18,460	176	570	13,177	200	459	3,878
1980	13,634	150	841	8,703	237	525	3,178
1981	10,916	132	619	6,840	255	453	2,617
1982	5,085	111	333	3,326	121	254	940
1983	3,356	133	187	2,172	129	216	519
1984	2,999	102	143	2,013	83	233	425
1985	2,683	126	239	1,545	152	137	484
1986	2,151	171	116	1,031	159	210	464
1987	1,800	187	77	576	170	281	509
1988	1,949	206	103	500	217	280	643

Source: Civil shipments data from company reports to AIA and General Aviation Manufacturers Association. Export data from Dept. of Commerce (Bureau of Census) Report FT410.

[a] Prior to 1976, includes the C-130 military transport.

U.S. AIRCRAFT PRODUCTION—MILITARY

Calendar Years 1969-1988

MILITARY AIRCRAFT

Year	TOTAL	U.S. Military Agencies	Exports		
			Total	FMS[a]	Direct[b]
1969	4,290	3,644	646	NA	NA
1970	3,720	3,085	635	NA	NA
1971	2,914	2,232	682	NA	NA
1972	2,530	1,993	537	124	413
1973	1,821	1,243	578	129	449
1974	1,513	799	714	365	349
1975	1,779	844	935	525	410
1976	1,318	625	693	518	175
1977	1,134	454	680	408	272
1978	996	467	529	256	273
1979	837	531	306	203	103
1980	1,047	625	422	194	228
1981	1,062	703	359	215	144
1982	1,159	690	469	68	401
1983	1,053	766	287	70	217
1984[r]	936	561	375	71	304
1985	919	643	276	134	142
1986[r]	1,107	708	399	110	289
1987	1,199	858	485	133	352
1988	1,443	825	618	138	480

Source: Military acceptances for use of U.S. military agencies and for reimbursable programs reported by USAF, USN and Army. Export data from Dept. of Commerce (Bureau of the Census) Report FT 410.

[a] Also includes acceptances of NATO AWACS aircraft.

[b] Military aircraft exported via commercial contracts, directly from manufacturers to foreign governments.

[r] Revised.

NA Not available.

CIVIL AIRCRAFT SHIPMENTS

Calendar Years 1974-1988

Year	TOTAL	Transport Aircraft[a]	Helicopters	General Aviation
NUMBER OF AIRCRAFT SHIPPED				
1974	15,326	332	828	14,166
1975	15,251	315	864	14,072
1976	16,429	222	757	15,450
1977	17,913	155	848	16,910
1978	18,962	241	904	17,817
1979	18,460	376	1,029	17,055
1980	13,634	387	1,366	11,881
1981	10,916	387	1,072	9,457
1982	5,085	232	587	4,266
1983	3,356	262	403	2,691[b]
1984	2,999	185	376	2,438
1985	2,683	278	376	2,029
1986	2,151	330	326	1,495
1987	1,800	357	358	1,085
1988	1,949	423	383	1,143
VALUE—Millions of Dollars				
1974	$ 5,091	$3,993	$ 189	$ 909
1975	5,086	3,779	274	1,033
1976	4,592	3,078	285	1,229
1977	4,451	2,649	251	1,551
1978	6,458	4,308	328	1,822
1979	10,644	8,030	403	2,211
1980	13,058	9,895	656	2,507
1981	13,223	9,706	597	2,920
1982	8,610	6,246	365	1,999
1983	9,773	8,000	303	1,470[b]
1984	7,717	5,689	330	1,698
1985	10,384	8,448	505	1,431
1986	11,857	10,308	287	1,262
1987	12,148	10,507	277	1,364
1988	15,855	13,603	334	1,918

Source: Transport Aircraft and Helicopters: Aerospace Industries Association, company reports.
General Aviation: General Aviation Manufacturers' Association and Aerospace Industries Association.

[a] U.S.-manufactured fixed-wing aircraft over 33,000 pounds empty weight, including all jet transports plus the four-engine turboprop-powered Lockheed L-100.

[b] Includes 3 off-the-shelf Gulfstream G-III's delivered to the U.S. Air Force for C-20 VIP transports.

CIVIL TRANSPORT AIRCRAFT BACKLOG[a]

As of December 31, 1984–1988

Company and Model	1984	1985	1986	1987	1988
TOTAL AIRCRAFT ON ORDER					
(Domestic and Foreign Orders) .	489	662	660	824	1,373
Value (Millions of Dollars)	$16,588	$19,519	$22,264	$32,401	$58,474
Boeing-TOTAL	345	472	451	573	937
B-737	170	304	269	342	488
B-747	38	51	84	120	153
B-757	62	77	63	67	205
B-767	75	40	35	44	91
Lockheed-TOTAL	2	2	—	2	1
L-1011	2	—	—	—	—
L-100	—	2	—	2	1
McDonnell Douglas-TOTAL	142	188	209	249	435
MD-11	—	—	—	29	88
MD-80	137	180	203	213	346
DC-10	5	8	6	7	1
TOTAL FOREIGN ORDERS	167	252	293	420	840
Value (Millions of Dollars)	$6,941	$7,929	$12,467	$20,196	$39,504
Boeing-TOTAL	120	158	192	293	547
B-737	45	98	93	137	263
B-747	38	38	68	95	124
B-757	7	8	9	28	91
B-767	30	16	22	33	69
Lockheed-TOTAL	2	2	—	2	—
L-1011	2	—	—	—	—
L-100	—	2	—	2	—
McDonnell Douglas-TOTAL	45	90	101	125	293
MD-11	—	—	—	27	75
MD-80	45	90	99	95	217
DC-10	—	—	2	3	1

Source: Aerospace Industries Association, company reports.

[a] Unfilled firm orders on the books, excluding options, and new aircraft contracted for lease from manufacturer to customer, for U.S. manufactured transport aircraft over 33,000 lbs. including all jet transports plus the turboprop-powered Lockheed L-100.

SHIPMENTS OF CIVIL TRANSPORT AIRCRAFT[a]

Calendar Years 1984–1988

Company and Model	**1984**	**1985**	**1986**	**1987**	**1988**
TOTAL					
Number of Aircraft Shipped	185	278	330	357	423
Value (Millions of Dollars)	$5,689	$8,500	$10,308	$10,507	$13,603
Boeing—TOTAL	138	200	238	257	289
B-727	8	-	-	-	-
B-737	67	115	141	161	165
B-747	16	24	35	23	24
B-757	18	36	35	40	48
B-767	29	25	27	33	52
Lockheed—TOTAL	7	7	1	2	5
L-1011	4	2	-	-	-
L-100	3	5	1	2	5
McDonnell Douglas—TOTAL	40	71	91	98	129
MD-80	38	71	86	95	121
DC-10	2	-	5	3	8

Source: Aerospace Industries Association, company reports.

[a] U.S.-manufactured fixed-wing aircraft over 33,000 lbs. empty weight; all are jet-powered except the four-engine turboprop-powered Lockheed L-100.

SPECIFICATIONS OF U.S. CIVIL JET TRANSPORT AIRCRAFT

On Order or in Production as of 1988

Number of Engines and Crew, and Model Designation[b]	Initial Service	Standard Mixed Class	Operating Empty Weight (000's lbs)	Maximum Takeoff Gross Weight (000's lbs)	Range (Nautical Miles)[c]	Engines (Manufacturer[d] and Model)
FOUR ENGINES/CREW OF 3						
747-200B*	1971	452	374	775-833	5,350	P&W JT9D-7R4G2
747SP*	1976	331	333	700	7,670	R-R RB.211-524D4
747-300B*	1983	496	383	775-833	7,310	P&W JT9D-7R4G2
747-400*	1988	509	390	870	8,380	P&W 4000 or GE CF6-80C2
THREE ENGINES/CREW OF 3						
DC-10-10*	1971	250	243	440	3,750	GE CF6-6D
DC-10-15*	1981	278	249	455	4,422	GE CF6-50C2-F
DC-10-30*	1972	275	267	580	6,357	GE CF6-50C2
DC-10-40*	1972	275	271	580	5,988	P&W JT9D-59A
MD-11*	1989	321-405	277	603	8,070	P&W PW4360 or GE CF6-80C2
MD-11ER*	1989	277	265	603	8,525	P&W PW4360 or GE CF6-80C2
TWO ENGINES/CREW OF 2						
737-200	1971	110	61	116-119	1,800	P&W JT8D-9A151717R
737-300	1984	141	69	125-136	2,300	CFMI-CFM56-3-B1
737-400	1988	159	73	139	2,250	CFMI-CFM56-3B2
757-200	1982	186	128	220-240	4,550	RR RB211-535CE4 or P&W 2037
767-200*	1982	216	176	315	4,566	P&W JT9D-7R4 or GE CF6-80A
767-200ER*	1984	216	180	351	5,942	P&W JT9D-7R4 or GE CF6-80A
767-300*	1986	261	190	351	4,650	P&W JT9D-7R4 or GE CF6-80A
767-300ER*	1987	261	196	400	6,650	P&W 4000 or GE CF6-80C2
80:						
MD-81	1980	142	78	140	1,700	P&W JT8D-209
MD-82	1981	142	78	149	2,080	P&W JT8D-217A
MD-83	1985	142	80	160	2,590	P&W JT8D-219
MD-87	1987	130	73	140	2,740	P&W JT8D-217C
MD-88	1987	142	78	150	2,150	P&W JT8D-217C

Source: Aerospace Industries Association, based on company reports.

[a] All jet-powered passenger transport aircraft 33,000 pounds or more empty weight.

[b] Manufacturers are The Boeing Company (727,737,747,757, and 767), and McDonnell Douglas Corporation (MD-80, MD11, and DC-10).

[c] Full passenger load and baggage.

[d] P&W = Pratt and Whitney Aircraft Company of United Technologies Corporation;
GE = General Electric Company; RR = Rolls Royce Limited; CFMI = General Electric/Snecma.

* Wide-body aircraft.

SPECIFICATIONS OF U.S. CIVIL HELICOPTERS

In Production as of 1988

Company	Commercial Model	Number of Places	Useful Load (Lbs.)	Range with Useful Load (N. Miles)	External Cargo Payload (Lbs.)
Bell Helicopter Textron Textron Inc.	206 Series	4-5	1315-1630	240-304	1200-1500
	206L Series	7	1894-1931	297-308	2000
	212	15	5238	226	5000
	214 Series	16-18	5450-8035	219-435	6000-8000
	222	7-10	2985	356	2500
	412	15	5333	232	5000
Boeing Vertol Company	234 (LR)	47	23,3[illegible]	620	28000
	234 (UT)	3	30,0[illegible]	264	28000
The Enstrom Helicopter Corp.	F-28 Series	3	700-850	238-272	500-1000
	280 Series	3	700-850	243-272	500-1000
Hiller Helicopters Rogerson Aircraft Corp.	12-E Series	3-4	1264-1341	215	1000
	12-ET Series	3-4	1450	351	1000
	RH-1100	5	1355	396	1500
Hynes Helicopter, Inc.	B-2B	2	670	225	400
	305	5	1200	275	800
McDonnell Douglas Helicopter Co.[b]	300 Series[a]	3	698-1004	191-224	1104
	500 Series	4-7	1320-1660	276-287	1560-2000
Robinson Helicopter Co.	R22	2	468	208	-
Schweizer Aircraft Corp.	300C[a]	3	698-1004	191-224	1104
Sikorsky Aircraft Div.	S-76 (MARK II)	14	4525	466	4200
United Technologies Corp.	S-70C Commercial Utility	19	11,862	297	8000

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada, Mexico and Puerto Rico, 1982/83" and "AIA Directory of VTOL Aircraft, 1983."

[a] In 1983, Schweizer Aircraft became the licensed manufacturer for the Hughes 300C, redesignated the Schweizer-Hughes 300C, with product support beginning in 1983, and production beginning in 1984.

[b] McDonnell Douglas Corporation acquired Hughes Helicopters in January 1984.

CIVIL HELICOPTER SHIPMENTS[a]

Calendar Years 1984-1988

Company and Model	1984	1985	1986	1987	1988
CIVIL SHIPMENTS	376	376	326	358	383
Value (Millions of Dollars)	$330	$505	$287	$277	$334
Bell[b]-TOTAL	151	146	125	127	62
206 series	94	87	67	74	—
212	18	8	11	11	13
214 series	13	10	15	13	18
222	26	22	20	12	11
412	—	19	12	17	20
Boeing Vertol-TOTAL	—	4	—	—	—
234	—	4	—	—	—
Enstrom-TOTAL	5	18	10	12	17
F-28 series	2	11	3	7	7
280 series	3	7	7	5	10
Hiller-TOTAL	—	2	—	—	—
12-E series	—	2	—	—	—
12-ET series	—	—	—	—	—
McDonnell Douglas-TOTAL	92	56	65	41	44
269 series	—	—	1	—	—
500 series	85	48	40	37	39
530 series	7	8	24	4	5
Robinson-TOTAL	79	79	90	127	204
R22	79	79	90	127	204
Schweizer-TOTAL	11	24	23	37	45
300C	11	24	23	37	45
Sikorsky (UTC)-TOTAL	38	47	13	14	11
S-76	27	19	10	13	11
S-70A	2	—	—	—	—
S-70B-3	—	2	—	—	—
S-70C-series	9	26	3	1	—

Source: Aerospace Industries Association, company reports

NOTE: All data exclude production by foreign licensees.

[a] Domestic and export helicopter shipments for non-military use. The data in this table have been revised to separate out direct military exports (involving commercial contracts between U.S. manufacturers and foreign governments) which are now reported elsewhere in this chapter. Models which may be shipped in either a civil or a military configuration appear in both tables.

[b] Beginning in 1987 Bell Helicopter moved production of its 206 series helicopters to its Canadian facility.

DIRECT EXPORT SHIPMENTS OF MILITARY HELICOPTERS[a]

Calendar Years 1984-1988

Model	1984	1985	1986	1987	1988
DIRECT MILITARY EXPORT SHIPMENTS	31	38	10	21	66
Value (Millions of Dollars)	$59	$75	$77	$57	$352
Bell AH-1S	—	10	—	—	24
Boeing Vertol CH-47/414/352	3	3	6	4	1
McDonnell Douglas 500MD (TOW)/ 500 Scout	24	25	—	11	19
Schweizer 300C	—	—	4	6	—
Sikorsky S-76	4	—	—	—	—
Sikorsky S-70C	—	—	—	—	13
Sikorsky MH53	—	—	—	—	9

Source: Aerospace Industries Association, company reports.

[a] Shipments of helicopters in military configuration exported directly from U.S. manufacturers to foreign governments. Military helicopters exported via Foreign Military Sales (FMS) are reported with Dept. of Defense (DOD) aircraft acceptance data elsewhere in this chapter. Some models reported on this page may be shipped in either military or civil configuration; see Civil Helicopter Shipments table for additional data.

GENERAL AVIATION AIRCRAFT SHIPMENTS

By Selected Manufacturers
Calendar Years 1984-1988

	1984	1985	1986	1987	1988
NUMBER OF AIRCRAFT SHIPPED	2,438	2,029	1,495	1,085	1,143
Single-Engine, Piston	1,621	1,370	985	613	628
Multi-Engine, Piston	374	193	138	87	67
Turboprop	272	321	250	263	291
Turbojet	171	145	122	122	157
VALUE OF SHIPMENTS[a] (Millions of Dollars)	$1,698	$1,431	$1,262	$1,364	$1,918
Single-Engine, Piston	$ 149	$ 124	$ 80	$ 80	$ 66
Multi-Engine, Piston	135	56	43	18	12
Turboprop	443	542	430	477	596
Turbojet	971	709	709	789	1,242
Number of Aircraft By Selected Manufacturer					
Beech	411	288	305	314	372
Cessna	978	881	549	187	161
Fairchild	29	35	37	36	29
Gates Learjet	33	33	20	16	23
Gulfstream	58	55	26	30	51
Lake	26	20	26	23	28
Maule	65	88	64	54	55
Mooney	151	90	142	143	142
Piper	664	538	326	282	282
Schweizer Aircraft	23	*(b)*	*(b)*	*(b)*	*(b)*

Source: General Aviation Manufacturers' Association and Aerospace Industries Association.

[a] Manufacturers' net billing price.

[b] Data not reported after 1984.

MILITARY AIRCRAFT ACCEPTED BY U.S. MILITARY AGENCIES

Number and Flyaway Value
Calendar Years 1974-1988

Year	TOTAL	Bomber/ Patrol/ Command/ Control	Fighter/ Attack	Trans-port/ Tanker	Trainer	Heli-copter	Other
NUMBER							
1974	1,110	50	478	27	49	506	—
1975	1,369	62	624	34	40	601	8
1976	1,143	55	646	67	11	348	16
1977	862	44	488	25	12	273	20
1978	723	30	478	28	—	166	21
1979	734	17	529	16	—	158	14
1980	819	16	551	15	18	189	30
1981	918	19	649	17	60	158	15
1982	758	26	478	14	60	172	8
1983	836	34	421	22	120	233	6
1984	632	34	298	18	30	240	12
1985	777	34	409	25	—	306	3
1986[r]	818	52	424	76	—	266	—
1987[r]	858	74	483	36	—	265	—
1988	825	54[E]	498	31	—	242	—
FLYAWAY VALUE—Millions of Dollars							
1974	$2,224	$584	$1,222	$101	$111	$ 206	$ —
1975	3,172	599	2,054	128	27	359	5
1976	4,729	547	3,421	340	27	384	10
1977	4,364	499	3,190	331	14	316	14
1978	4,664	689	3,496	237	—	225	17
1979	5,470	442	4,660	136	—	219	13
1980	6,514	475	5,282	178	32	516	31
1981	8,446	526	6,518	509	32	825	19
1982	8,605	886	6,383	410	42	872	12
1983	9,640	1,259	6,708	575	79	1,009	10
1984	9,308	1,270	5,774	627	18	1,597	22
1985	14,122	3,640	7,923	838	—	1,715	6
1986[r]	20,903	8,177	8,004	(2,665)	—	2,057	—
1987[r]	21,459	8,569	8,900	2,218	—	1,772	—
1988	16,832	3,829[E]	8,834	2,334	—	1,835	—

Source: Departments of the Army, Navy, and Air Force.

NOTE: Data represent new U.S.-manufactured aircraft, excluding gliders and targets. Values include spares, spare parts, and support equipment that are procured with the aircraft. Effective 1972, includes aircraft accepted for shipment to foreign governments for military assistance programs and foreign military sales. 1972-1975, flyaway value does not include the value of planes produced for the security assistance programs and accepted by the USAF.

E Estimated.

MILITARY AIRCRAFT ACCEPTANCES BY UNITED STATES AIR FORCE[a]

Calendar Years 1987-1988
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1987[r]	1988	1987[r]	1988	1987[r]	1988
AIR FORCE—TOTAL	304	277[E]	$13,665	$ 8,001[E]	$15,438	$ 9,074[E]
Fighter/Attack—TOTAL	213	211	3,458	3,230	4,607	4,099
F-15	39	34	1,197	997	1,826	1,317
F-16	174	177	2,261	2,233	2,781	2,782
Bombers—TOTAL	52	17[E]	7,945	2,329[E]	8,407	2,397[E]
B-1B	52	17	7,945	2,329	8,407	2,397
Transports/Tankers—TOTAL	36	31	2,218	2,334	2,273	2,369
C-5B	13	22	1,599	2,159	1,624	2,185
KC-10A	7	1	403	59	414	59
C-130H	16	8	216	116	235	125
Command/Control—TOTAL	3	2	44	29	151	88
TR-1A	3	2	44	29	151	88
Helicopters—TOTAL	0	16	0	79	251	121
MH-60G	0	16	0	79	76	121

Source: Department of the Air Force.

NOTE: Costs shown are approximate. Calendar year acceptances may derive from procurement quantities funded in more than one fiscal year.

[a] Air Force acceptances for own use; exclude FMS/MAP shipments.

[b] Flyaway Cost includes airframe, engines, electronics, communications, armament, other installed equipment and non-recurring costs associated with the manufacture of the aircraft.

[c] Weapon System Cost includes flyaway costs, peculiar ground equipment, training equipment and technical data.

[d] Excludes 3 C-20's (off-the-shelf Gulfstream G-3's) delivered to the Air Force (for VIP transport) and included in civil general aviation shipments.

[r] Revised

[E] Estimate

MILITARY AIRCRAFT ACCEPTANCES BY UNITED STATES ARMY[a]

Calendar Years 1987 and 1988
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1987	1988	1987	1988	1987	1988
ARMY—TOTAL	206	190	$ 1,376[r]	$ 1,392	$ 1,530	$ 1,574
Helicopters—TOTAL	206	190	1,376[r]	1,392	1,530	1,574
UH-60A	81	72	372[r]	376	428[r]	425
AH-64	125	118	1,004[r]	1,016	1,102	1,149

Source: Department of the Army.

[a] Army acceptances for own use; exclude FMS/MAP shipments.

[b] Flyaway cost includes airframes, engines, electronics, communications, armament and other installed equipment.

[c] Weapon System Cost includes flyaway items, initial spares, ground equipment, training equipment and other support items.

[r] Revised.

MILITARY AIRCRAFT ACCEPTANCES BY UNITED STATES NAVY[a]

Calendar Years 1987-1988
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1987[r]	1988	1987[r]	1988	1987[r]	1988
NAVY—TOTAL	215	220	$3,765	$4,354	$5,046	$5,334
Patrol—TOTAL	18	35	$ 473	$ 571	$ 808	$ 774
P-3C	9	6	266	167	358	211
EA-6B	9	12	207	338	450	400
S-3B	0	17	0	66	0	163
Fighter/Attack—TOTAL	138	149	2,896	3,419	3,584	4,024
F-14A	8	17	274	590	317	688
F/A-18	87	82	1,964	2,053	2,331	2,370
AV-8B	36	42	511	630	659	774
A-6E	7	8	147	146	277	192
Helicopters—TOTAL	59	36	396	364	654	536
AH-1W	24	8	5	5	119	119
CH-53E	10	10	128	132	170	148
SH-60B	19	15	218	174	310	215
SH-2F	6	3	45	53	55	54

Source: Department of the Navy.

[a] Navy acceptances for own use; excludes FMS shipments.

[b] Flyaway Cost includes airframe, engines, electronics, communications, armament, other installed equipment, non-recurring costs and ancillary equipment.

[c] Weapon System Cost (Investment Cost) includes flyaway items, initial spares, ground equipment, training equipment and other support items.

[r] Revised.

MILITARY AIRCRAFT ACCEPTANCES FOR REIMBURSABLE PROGRAMS[a]

Calendar Years 1987-1988
(Millions of Dollars)

Accepting Agency, Type and Model	Number of Aircraft Accepted		Flyaway Cost[b]	
	1987	1988	1987	1988
TOTAL ACCEPTANCES FOR REIMBURSABLE PROGRAMS	133	138	$2,653[r]	$2,185
AIR FORCE—TOTAL	93	98	$1,671	$1,263
Fighter/Attack—TOTAL	92	98	1,564	1,263
F-16 C/D	92	98	1,564	1,263
Command/Control—TOTAL	1	0	107	0
E-3 (NATO AWACS)	1	0	107	0
NAVY—TOTAL	40	40	$982[r]	$922
Fighter/Attack—TOTAL	40	40	982	922
F/A-18	40	40	982	922
ARMY—TOTAL	0	0	0	0

Source: Departments of the Air Force, Navy, and Army.

[a] Foreign Military Sales and NATO AWACS Program.

[b] Flyaway cost includes airframes, engines, electronics, communications, armament, other installed equipment and nonrecurring costs associated with the manufacture of the aircraft.

[r] Revised.

MILITARY AIRCRAFT PROGRAM PROCUREMENT[a]

Fiscal Years 1988, 1989 and 1990
(Millions of Dollars)

Agency, Type and Model	1988		1989[E]		1990[E]	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
AC-130U	—	$18.2	6	$316.3	5	$239
C-17	2	654.2	4	995.6	6	1,691.6
C-27A	—	—	—	—	5	74.4
C-29A	6	75.0	—	—	—	—
C-130H Hercules	—	—	14	284.9	—	—
Civil Air Patrol (CAP) Aircraft	38	1.5	38	1.8	38	2.0
E-8A	—	—	—	—	—	55.5
F-15E Eagle	42	1,259.2	36	1,381.1	36	1,465.7
F-16 Falcon	180	2,575.9	180	3,031.7	150	3,012.1
KC-10A ATCA Extender	—	11.9	—	—	—	—
KC-135 Re-engining/Modern	47	762.2	47	743.8	24	385.1
LANTIRN (Night Precision Attack)	—	741.4	—	685.0	—	353.2
MC-130H Combat Talon	7	344.8	4	33.0	2	236.7
MH-60G	—	—	9	75.4	4	52.8
TR-1/U-2[b]	—	10.7	—	—	—	—
TTTS	—	—	1	9.5	14	147.4
ARMY						
AH-64 Attack Helicopter	101	$795.7	72	$932.1	72	$826.1
C-20	1	20.0	—	—	—	—
CH-47 Modernization	—	222.4	—	246.3	—	304.5
Cessna Skylane	2	0.2	—	—	—	—
EH-60A Quick Fix	—	11.8	—	—	—	—
Golden Knights Replacement AC	2	13.3	—	—	—	—
MH-60 SOF Helicopter	—	—	—	—	11	71.3
OH-58D AHIP Modification	36	158.7	36	202.6	36	276.4
RC-12D Guard Rail	3	43.8	6	67.4	5	52.7
UH-60A Black Hawk[c]	72	483.5	72	430.7	72	386.4
NAVY						
A-6 Intruder	10	$480.8	—	$ —	—	$ —
AH-1W Sea Cobra	34	226.5	—	54.7	—	—
AV-8B Harrier	24	548.8	24	516.2	24	491.1
CH/MH-53E Super Stallion	14	224.2	14	227.4	3	62.0
E-2C Hawkeye	6	374.2	6	335.9	4	486.2

(Continued on next page)

MILITARY AIRCRAFT PROGRAM PROCUREMENT[a] (Continued)

Agency, Type and Model	1988		1989[E]		1990[E]	
	No.	Cost	No.	Cost	No.	Cost
NAVY (Continued)						
E-6A	3	310.3	7	332.2	—	—
EA-6B Prowler	12	453.9	12	545.0	—	129.9
F-14D Tomcat	12	724.3	12	902.4	18	1,136.3
F/A-18 Hornet	84	2,329.2	84	2,428.1	72	2,576.6
KC-130T	2	40.0	2	45.0	—	—
P-3C Orion	6	211.7	—	—	—	—
SH-60B Seahawk LAMPS MK-111	6	121.6	6	106.6	6	187.3
SH-60F CV ASW	18	293.5	18	352.9	18	284.2
T-45 Training System	12	368.1	24	413.3	24	417.1
HH-60H[c]	9	99.0	—	15.4	—	—
V-22[d]	—	—	—	333.9	12	1,266.6

Source: "Program Acquisition Costs by Weapon System," "Procurement Programs (P-1)" Department of Defense Budget, Annually).

NOTE See Research and Development Chapter for aircraft program RDT&E authorization data.

a Total Obligational Authority for procurement, excluding initial spares.

b Includes ground stations.

c Army, Navy and Air Force funding.

E Estimate. Latest year reflects Administration's budget proposal.

d Navy and Air Force funding.

ACTIVE U.S. MILITARY AIRCRAFT IN CONTINENTAL U.S.[a]

Fiscal Years 1979-1990

Fiscal Year	Total	Fixed Wing Aircraft				Helicopter
		Total	Jet	Turboprop	Piston	
1979	18,526	11,365	8,656	1,859	850	7,161
1980	18,969	11,362	8,794	1,869	699	7,607
1981	19,363	11,645	9,111	1,943	591	7,718
1982	21,728	12,063	9,647	1,900	516	9,665
1983	18,652	11,603	9,495	1,745	363	7,049
1984	18,833	11,661	9,551	1,777	333	7,172
1985	19,333	11,929	9,640	1,881	408	7,404
1986	20,157	11,919	9,730	1,803	386	8,238
1987	20,514	12,054	9,819	1,865	370	8,460
1988[E]	20,729	12,149	9,899	1,890	360	8,580
1989[E]	20,971	12,173	9,905	1,910	358	8,798
1990[E]	21,109	12,234	9,959	1,925	350	8,875

Source: Department of Defense, Office of the Secretary of Defense, reported in "FAA Aviation Forecasts" (Annually).

a Includes Army, Air Force, Navy and Marine regular service aircraft, as well as Reserve and National Guard Aircraft.

E Estimate.

DEPARTMENT OF DEFENSE OUTLAYS FOR AIRCRAFT PROCUREMENT

By Agency
Fiscal Years 1962-1990
(Millions of Dollars)

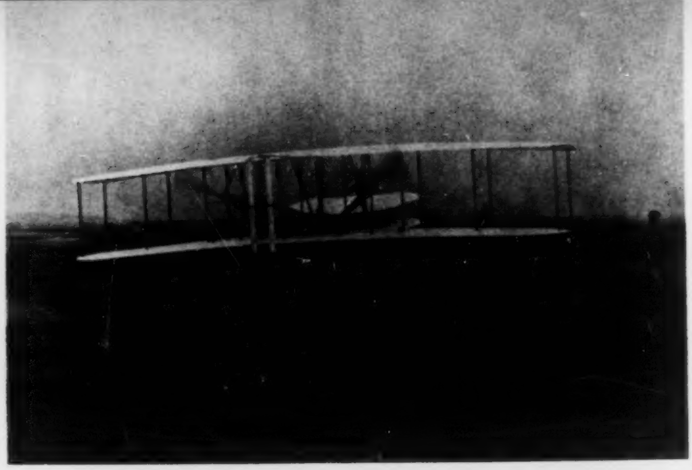
Year	TOTAL AIRCRAFT PROCUREMENT	Air Force	Navy[a]	Army
1962	$6,659	$4,387	$2,102	$170
1963	6,309	3,747	2,328	234
1964	6,053	3,894	1,859	300
1965	5,200	3,115	1,739	346
1966	6,635	4,074	2,021	540
1967	8,411	4,842	2,607	962
1968	9,462	5,079	3,244	1,139
1969	9,177	5,230	2,821	1,126
1970	7,948	4,623	2,488	837
1971	6,631	3,960	2,125	546
1972	5,927	3,191	2,347	389
1973	5,066	2,396	2,557	113
1974	5,006	2,078	2,806	122
1975	5,484	2,211	3,137	136
1976	6,520	3,323	3,061	136
Tr. Qtr.	1,557	859	672	26
1977	6,608	3,586	2,721	301
1978	6,971	3,989	2,602	380
1979	8,836	5,138	3,140	558
1980	11,124	6,647	3,689	787[r]
1981	13,193	7,941	4,397	855
1982	16,793	9,624	5,872	1,297
1983	21,013	11,799	7,490	1,724
1984	23,196	12,992	8,040	2,165
1985	26,586	15,619	8,263	2,705
1986	30,828	18,919	8,922	2,987
1987	32,956	20,036	9,614	3,306
1988	28,246	15,961	9,407	2,878
1989[E]	28,751	16,536	9,346	2,869
1990[E]	26,510	14,678	9,019	2,813

Source: Department of Defense Budget (Annually).
NOTE: Detail may not add to totals because of rounding.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.
Tr.Qtr. Transition quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. Beginning October 1, 1976, the fiscal years run from October 1 through September 30. A three-month "Transition Quarter" from July 1 through September 30, 1976 belongs to neither fiscal year

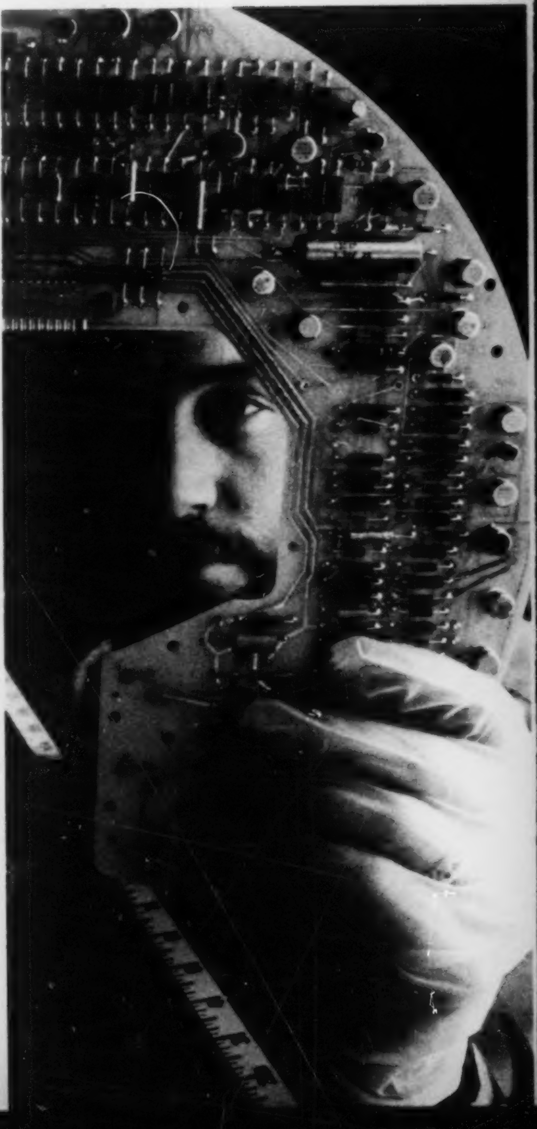
SPECIFICATIONS OF U.S. MILITARY AIRCRAFT ON ORDER OR IN PRODUCTION AS OF 1988

Primary Mission, DOD Designation, & Popular Name	Manufacturer	U.S. Military Service	Crew	Empty Weight (000's lbs)	Engines	Performance Typical for Primary Mission	Remarks
ATTACK							
A-6E Intruder	Grumman	USN/USMC	2	27	2xP&W J52	Mach 8 sea level	Also EA-6A/B & KA-6D
A-6F	Grumman	USN/USMC	2	27	2xGE F404-GE-400	Ordinance & missiles	Improved radar & avionics
AV-8B Harrier 2	MDC/BR.Aer.	USMC	1	13	1xRR F402	Mach 9+	Graphite/epoxy super-critical wing
BOMBERS							
B-1B	Rockwell	USAF	4	182	4xGE F101	High subsonic penetration	Intercont'l range, unrefueled
ELECTRONIC WARFARE							
EA-6A Intruder	Grumman	USN/USMC	2	28	2xP&W J52	597n.m. standoff radius	Limited strike capability
EA-6B Prowler	Grumman	USN/USMC	4	33	2xP&W J52	493n.m. standoff radius	Tactical jamming system
FIGHTERS							
F-5E Tiger 2	Northrop	USAF/USN	1	10	2xGE J85	Mach 1.6 class	More than 1,200 F-5E/Fs delivered
F-5F Tiger 2	Northrop	USAF/USN	2	11	2xGE J85	Mach 1.5 class	2-seat trainer/fighter
F-14A Tomcat	Grumman	USN	2	40	2xP&W TF30	Mach 2.3 class	Missile, gun fleet defense
F14+	Grumman	USN	2	42	2xGE F110	Mach 2.3 class	F-14A with upgraded engines and radar
F14D	Grumman	USN	2	-	2xGE F110	Mach 2.3 class	F14A+ with improved avionics and infrared track and search system
F-15C/D Eagle	MDC	USAF	1-2	31	2xP&W F100	Mach 2.5 class	Air superiority, defense, guns, missiles; 15D = 2 seat trainer
F-15E	MDC	USAF	2	-	2xP&W F100	Mach 2.5 class	Dual role fighter/long range interdiction
F-16 A/B Fighting Falcon	GD	USAF	1-2	15	1xP&W F100	Mach 2+ class	Multirole fighter; fully fly-by-wire; missiles, guns.
F-16 C/D	GD	USAF	1-2	—	1xP&W F100/ 1xGE F110	Mach 2+ class	Provisions for AMRAAM, LANTIRN and new EW Nav. Comm. systems.
F/A-18 Hornet	MDC/Northrop	USN/USMC	1	24	2xGE F404	Mach 2+ class	Missiles, guns; also export
COMMAND/CONTROL AND PATROL							
RC-12D	Beech	Army	2	9	2xPWC PT6-41	Max 294 kias	Modification of super king air 200
TR-1/U-2	Lockheed	USAF	1	18	1xP&W J75	Altitudes 70,000 ft+	High alt. tactical recon.
P-3C Orion	Lockheed	USN	10	67	4xAll T56	14+ hr. mission duration	Torpedoes, missiles, sonobuoys, mines; also export
E-2C Hawkeye	Grumman	USN	5	38	2xAll T56	6 hr. mission duration	AEW command & control; passive detection
E-3A AWACS	Boeing	USAF/NATO	17	188	4xP&W TF33	Long range, subsonic control	Surveillance radar, command.
CARGO-TRANSPORT							
C-2A Greyhound	Grumman	USN	2	34	2xAll T56	Cruise 260kt; 1,560n.m. range	First Navy multi-year procurement contract
C/KC-130 Hercules	Lockheed	USAF, USN Export	4	74-78	4xAll T56	Cruise 385mph; 2,038n.m. range	92-128 troops or 39-43 thsnd. lbs.
C-5B Galaxy	Lockheed	USAF	6	363	4xGE TF39	Cruise 563mph; 3,000n.m. range	Global strategic logistics; 208,000 lb. cargo capacity
C-12 Huron	Beech	Army/ USAF	2 2	8	2xPWC PT6A	Cruise 259kt. at 14,000ft.	10-place; pass. or cargo
KC-12A Extender	MDC	USAF	5	241	3xGE CF6	600+ mph.	Tanker or cargo
C-20A G3	Gulfstream	USAF	2	32	2xRR Spey	Mach.77; 3,650 n.m.	VIP transport; 14 pass.
TRAINING							
T-45A	MDC/BR.Aer.	USN	2	9	1xRR MK871	Cruise 609 mph at 8,000 ft.	Next generation trainer
HELICOPTERS							
AH-1T Sea Cobra	Bell-Textron	USN	2	9	2xPWC T400	Max 218 mph; 360 mi.	TOW w/20 mm gun
AH-1S Cobra	Bell-Textron	Army	2	6	1xLyc T53	Max 195 mph; 380 mi.	TOW w/mini gun
AH-1W Super Cobra	Bell-Textron	USN	2	10	2xGE T700	Max 218 mph	TOW, hellfire
AH-64 Apache	Hughes-MDC	Army	2	11	2xGE T700	Max 197 mph; 445 mi.	Attack helicopter
CH/MH-53E	Sikorsky-UTC	USN	3-8	33-36	3xGE T64	Max 196 mph; 710 mi.	55 passengers, aux. tanks/minesweeping
SH-2F Seasprite	Kaman	USN	3	7	2xGE T58	Max 165 mph; 400 mi.	LAMPS Mk.1 helicopter
TH-57A Sea Ranger	Bell-Textron	USN	2	2	1xAll 250	Max 140 mph; 425 mi.	Primary trainer
SH-60B Seahawk	Sikorsky-UTC	USN	3	14	2xGE T700	Max 171 mph	ASW
SH-60F Cv-Helo	Sikorsky-UTC	USN	4	14	2xGE T700	Max 177 mph	Inner Zone ASW
UH-1H Iroquois	Bell-Textron	Army	2	5	1xLyc. T53	Max 127 mph; 286 mi.	Succeeds UH-1D
UH-60A Black Hawk	Sikorsky-UTC	Army/USAF	3	11	2xGE T700	Max 196 mph; 370 mi.	UTTAS

Source: Aerospace Industries Association, based on information from "Aviation Week & Space Technology" Magazine.
CODE: Manufacturers: MDC = McDonnell Douglas; Br.Aer. = British Aerospace; GD = General Dynamics
U.S. Military Service: USN = Navy; USMC = Marine Corps; USAF = Air Force; ANG = Air National Guard
Engines: P&W = Pratt & Whitney; PWC = Pratt & Whitney of Canada; All = Allison Gas Turbine Div. of General Motors; Lyc = Avco Lycoming; RR = Rolls Royce



Missile Programs



On the rise throughout the 1980s, industry sales of missile systems declined—though minimally—in 1988 for the first time since 1977. The flow of new orders for missile systems fell sharply and backlog dipped slightly.

According to Bureau of the Census reports, sales of missile systems and parts in 1988 amounted to $9.5 billion, in rounded-off figures the same as in 1987 but actually some $43 million lower.

The flow of new missile orders dropped 19 percent to $9.4 billion in 1988, down from $11.7 billion in 1987. Backlog for missile systems and parts was $14.3 billion at yearend 1988, compared with $14.6 billion at the end of the previous year.

The Bureau of the Census separately reported sales of missile-related propulsion systems as part of a statistical grouping that also includes propulsion units for space launch vehicles, both civil and military.

In 1988, total sales in that grouping came to $3.4 billion, up from $3 billion in each of the two preceding years. Military sales—which include missile propulsion units—increased from $1.6 billion in 1987 to $1.8 billion in 1988; non-military sales, at $1.6 billion in 1988, were up from 1987's $1.4 billion.

Net new orders for missile/space propulsion systems came to $3.5 billion, up from

$3.3 billion in 1987. The beginning of a decline in missile activity was reflected in a sharp drop in new orders for military systems, from $2 billion in 1987 to $1.6 billion in 1988; nonmilitary orders, by contrast, increased by more than 46 percent to $1.9 billion (up from $1.3 billion).

The yearend 1988 backlog for missile/space propulsion units was $4 billion, evenly divided with $2 billion military, $2 billion nonmilitary.

The Department of Defense Fiscal Year 1990 budget plan contemplated missile procurement outlays of $13.8 billion, a slight increase over FY 89's $13.4 billion. The breakdown for FY 1990 is: Air Force $7.3 billion, Navy $4.2 billion, Army $2.3 billion. These figures serve only as an approximate guideline, since Congressional actions, not finalized at publication time, will necessitate some revision of the procurement plan.

The plan, however, serves as a general indicator of funding priorities and program scopes as envisioned by the Department of Defense. Under the plan, the missile program with the highest procurement dollar value (excluding initial spares and RDT&E) was the Navy's Trident II Fleet Ballistic Missile; the Navy planned a buy of 63 additional missiles at a cost of $1.8 billion.

The next largest planned procurement was an Air Force outlay of $1.1 billion for another increment of 12 Peacekeeper (M-X) ICBMs. The Air Force also planned to procure 1,600 more AMRAAM (Advanced Medium Range Air-to-Air Missile) units costing $1 billion for use by both the USAF and the Navy. The Army's top procurement was $925 million for 815 Patriot long-range air defense missiles.

Other major missiles in production during 1988/89 or planned for initial production under FY 1990 funding included:

Air Force. The Infrared Imaging Maverick air-to-ground missile, $188.3 million; the Have Nap Israeli-designed standoff air-to-ground missile, $27 million; the SRAM II supersonic air-to-ground weapon for standoff launch against hard targets, $79.3 million.

Army. The LOS-F-H (Line-of-Sight, Forward, Heavy) air defense missile, $403.2 million; the Multiple Launch Rocket System, a mobile rocket battery, $314.8 million; the Laser Hellfire helicopter-launched antiarmor missile, used by both the Army and the Navy, $188.7 million; the Stinger short-range anticraft weapon used by all services, $187.5 million and, in a separate procurement, the Pedestal Mounted Stinger, $115.7 million; the ATACMS (Army Tactical Missile System), $140.9 million; the NLOS (Non Line-of-Sight) missile, also known as FOG-M (Fiber Optic Guided Missile), a mobile air defense weapon, $131.2 million; the Hawk mobile air defense missile, $55.4 million; and the Chaparral infrared homing air-to-surface missile, $30.8 million.

Navy. The ship-launched Tomahawk cruise missile, $572.3 million; the Phoenix long-range air-to-air weapon, $376.5 million; the HARM antiradiation air-to-surface missile for both Navy and USAF use, $371.5 million; the Standard Ship defense air-to-air missile, $310.6 million; the Harpoon air-launched antiship missile, $214.1 million; the RAM (Rolling Airframe Missile), a system for defense against antiship missiles, $90.3 million; the Maverick air-to-surface weapon, $66.5 million; and the Penguin antiship missile, $43.3 million.

MISSILE PROGRAM PROCUREMENT[a]

Fiscal Years 1988, 1989 and 1990
(Millions of Dollars)

Agency, Type and Model	1988		1989[E]		1990[E]	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
ALCM	—	$ 2.3	—	$ —		$ —
AMRAAM[b]	400	670.0	900	830.2	1,600	1,032.7
GLCM	—	4.1	—	0.6	—	—
HAVE NAP	—	—	12	8.3	22	21.7
IIR MAVERICK[b]	3,300	350.0	2,820	258.3	2,270	188.3
Peacekeeper (M-X)	12	864.0	12	794.9	12	1,082.0
Rapier	—	4.1	—	—	—	—
SRAM II	—	—	—	—	—	10.8
Sidewinder	—	—	760	37.1	—	0.5
NAVY						
Harm[b]	2,297	$ 546.6	2,200	$ 513.1	1,488	$ 371.5
Harpoon	109	141.7	119	167.2	190	214.1
Hawk[e]	525	134.4	467	132.2	—	—
Laser MAVERICK[e]	1,300	157.3	—	—	—	—
MAVERICK[h]	—	—	731	81.9	560	66.5
PENGUIN	—	3.5	—	3.5	64	43.3
Phoenix	360	341.6	450	395.2	420	376.5
RAM	240	44.9	260	51.8	580	90.3
Sea Lance	—	—	—	—	—	1.8
Sidearm[g]	276	25.4	—	—	—	—
Sidewinder[b]	1,206	65.9	—	—	—	—
Sparrow[b]	1,158	138.5	624	77.3	—	—
Standard	1,310	561.3	1,310	586.6	590	310.6
Tomahawk	475	835.6	510	707.1	400	572.3
Trident II	66	2,041.3	66	1,865.6	63	1,814.6
VLA	—	—	300	104.4	—	—
ARMY						
ATACMS	—	$ 9.1	66	$ 70.7	276	$ 140.9
Chaparral	38	16.2	139	56.7	422	30.8
Hawk	—	—	—	—	358	55.4
Laser Hellfire[d]	7,393	243.8	7,000	239.5	4,200	188.7
LOS-F-H	—	33.5	60	108.4	424	403.2
MLRS	72,000	397.0	48,000	420.7	24,000	314.8
NLOS	—	—	—	—	—	32.5
Patriot	715	858.7	815	815.0	815	924.5
PMS Stinger	39	45.3	100	91.8	122	115.7
Stinger[f]	4,367	187.6	9,865	382.4	4,754	187.5
TOW 2[c]	12,000	159.7	14,566	168.8	10,294	124.7

Source: "Program Acquisition Costs by Weapon System," and "Procurement Programs(P-1)" Department of Defense Budget (Annually).

NOTE: See Research and Development Chapter for missile program RDT&E authorization data.

E Estimate. Latest year reflects Administration's budget proposal.

a Total Obligational Authority excluding initial spares and RDT&E.

b Navy and Air Force funding.

c Army and Marine Corps funding.

d Army and Navy funding.

e Marine Corps funding.

f Army, Marine Corps and Air Force funding.

g Navy and Marine Corps funding.

h In FY88 budgeted under IIR MAVERICK and Laser MAVERICK designations.

MAJOR MISSILES
RESEARCH, DEVELOPMENT, PRODUCTION, OPERATION

Program	Agency	Status	Systems Contractor(s)	Propulsion Manufacturer	Guidance Manufacturer
AIR-TO-AIR					
AMRAAM	USAF/USN	D,P	Hughes	Hercules	Hughes
Phoenix-54A	USN	O	Hughes	Hercules	Hughes
Phoenix-54C	USN	P	Hughes	Hercules	Hughes
Sidewinder-9J	USAF	O	Ford Aerospace	Hercules/ Aerojet	Ford Aerospace
Sidewinder-9L	USN/USAF	O	NASC	Bermite/ Hercules	Raytheon/ Ford Aero.
Sidewinder-9M	USN/USAF	P	NASC	Morton Thiokol/ Hercules	Raytheon Ford Aero.
Sidewinder-9N	USAF	O	Ford Aero.	—	Ford Aero.
Sidewinder-9P	USAF	P,O	Ford Aero.	Hercules/ Aerojet	Ford Aero.
Sidewinder-9R	USN	P	Ford Aero.	MTI/Hercules	Raytheon/ Ford Aero.
Sparrow-7F	USN/USAF	O	NASC	Hercules	Raytheon/GD
Sparrow-7M	USN/USAF	P	Raytheon/GD	Hercules	Raytheon/GD
AIR-TO-SURFACE					
ALCM	USAF	P	Boeing	Williams International	Honeywell/ Litton
HARM	USN/USAF	P	Texas Instr.	Morton/ Thiokol/ Hercules	Texas Instr.
Harpoon*	USN	P,O	McDonnell Douglas	Teledyne CAE	TI/IBM/LSI Northrop
GBU-15	USAF	P	Rockwell	Hughes	Hughes/ Rockwell
Maverick-65A/B	USAF	P,O	Hughes	MTI/Aerojet	Hughes
Maverick-65D	USAF	P,O	Hughes	MTI/Aerojet	Hughes
Maverick-65E	USMC	P	Hughes	MTI/Aerojet	Hughes
Maverick-65F	USN	P	Hughes	MTI/Aerojet	Hughes
Maverick-65G	USAF	D	Hughes	MTI/Aerojet	Hughes
Shrike	USN/USAF	O	NWC/PMTC	Aerojet/ Hercules	Texas Instruments
Sidearm 1	USN/USMC	P	Motorola	Hercules	Motorola
SLAM	USN	P	McDonnell Douglas	Teledyne CAE	MDC/Hughes/ Rockwell
SRAM	USAF	O	Boeing	Lockheed	Singer
Standard ARM	USN/USAF	O	GD	NOSIH	GD
Walleye 1	USN	O	Martin Marietta	—	Martin Marietta/ Hughes
Walleye 1ER	USN	R,D	NAC	—	NAC
Walleye 2	USN	O	NAC	—	NAC
Walleye 2 (ER/DL)	USN	O	NAC	—	NAC

*Also Surface-to-Surface

(Continued on next page)

MAJOR MISSILE PROGRAMS (Continued)

Program	Agency	Status	Systems Contractor(s)	Propulsion Manufacturer	Guidance Manufacturer
AIR-TO-SURFACE (Cont'd.)					
AGM-130A	USAF	D	Rockwell	Hercules	Rockwell
AGM-130B	USAF	D	Rockwell	Hercules	Rockwell
ANTI-SUBMARINE					
Subroc	USN	O	Goodyear Aerospace	Morton Thiokol	Singer
SURFACE-TO-AIR					
Chaparral	Army	O	Ford Aerospace	Hercules/Bermite	GE/Raytheon
Improved Chaparral	Army	P,O	Ford Aerospace	Bermite	Ford Aerospace
Hawk	Army	P,O	Raytheon	Aerojet	Raytheon
Patriot	Army	P	Raytheon	Morton Thiokol	Raytheon
RAM	USN	D	General Dynamics	Bermite/Hercules/MTI	General Dynamics
Redeye	Army/USMC	O	General Dynamics	Atlantic Research	General Dynamics
Roland	Army	O	Hughes/Boeing	Hercules	Hughes Boeing
Sea Sparrow	USN	P,O	Raytheon/GD	Aerojet/Hercules	Raytheon/GD
Standard MR (SM-1)	USN	P,O	General Dynamics	Aerojet/NOSIH	General Dynamics
Standard MR (SM-2)	USN	P,O	General Dynamics	Aerojet/MTI	General Dynamics
Standard ER (SM-1)	USN	O	General Dynamics	Atlantic Research/NOSIH	General Dynamics
Standard ER (SM-2)	USN	P,O	General Dynamics	Atlantic Research/NOSIH/MTI	General Dynamics
Stinger	Army USMC	P,O	General Dynamics	Atlantic Research	General Dynamics
SURFACE-TO-SURFACE					
Harpoon*	USN	P.O	McDonnell Douglas	Teledyne CAE	TI/IBM/LSI/Northrop
Minuteman 2	USAF	O	AFLC Hill AFB	MTI/Aerojet/Hercules/	Rockwell Autonetics
Minuteman 3	USAF	O	AFLC Hill AFB/	MTI/Aerojet	Rockwell Autonetics

*Also Air-to-Surface

(Continued on next page)

MAJOR MISSILE PROGRAMS (Continued)

Program	Agency	Status	Systems Contractor(s)	Propulsion Manufacturer	Guidance Manufacturer
SURFACE-TO-SURFACE (Cont'd)					
Peacekeeper (MX)	USAF	P,O	BMO/TRW	MTI/Avco/Aerojet/Hercules/Rocketdyne/GE	Rockwell/Northrop/Honeywell
Polaris A3	USN	O	Lockheed MSC	Aerojet/Hercules	GE/Hughes/MIT/Raytheon
Poseidon C3	USN	O	Lockheed MSC	MTI/Hercules	GE/MIT/Hughes/Raytheon
Tomahawk (SLCM)	USN	P	GD/MDC	Williams International	MDC/GD
Gryphon (GLCM)	USAF	P	GD/MDC	Williams International	MDC/GD
Trident 1 (C4)	USN	P,O	Lockheed MSC	Hercules/MTI	GE/Draper/Raytheon Hughes
Trident 2 (D-5)	USN	D,P	Lockheed MSC	Hercules/MTI/UTC	GE/Draper/Sperry/Rockwell
BATTLEFIELD SUPPORT AND ANTIARMOR					
Dragon	Army	P,O	MDC	MDC	MDC
Hellfire	Army/USMC	P	Rockwell	Morton Thiokol	Martin Marietta
Lance	Army	O	Vought	RI Rocketdyne	E-Systems/Sys-Donner/Arma
MLRS	Army	P,O	Vought	Atlantic Res.	—
Pershing 1A	Army	O	Martin Marietta	Morton Thiokol	Allied Bendix
Pershing 2	Army	P	Martin Marietta	Hercules	Goodyear Aerospace
Shillelagh	Army	O	Ford Aerospace	Hercules	Ford Aerospace
TOW	Army	O	Hughes	Hercules	Emerson El.
ITOW	Army	P,O	Hughes	Hercules	Emerson El.
TOW2	Army	P,O	Hughes	Hercules/MTI	Emerson El.
TOW2A	Army	P,O	Hughes	Hercules/MTI	Emerson El.

Source: Aerospace Industries Association, based on information from "Aviation Week & Space Technology" Magazine.
Status: R-Research; D-Development; P-Production; O-Operational.

Abb: AFB -Air Force Base
AFLC -Air Force Logistics Cmd.
BMO -Ballistic Missile Office of Technology
GD -General Dynamics
GE -General Electric
LSI -Lear Siegler
MM -Martin Marietta
MDC -McDonnell Douglas
MIT -Massachusetts Institute
RI -Rockwell International
MTI -Morton Thiokol, Inc.
NAC -Naval Avionics Center
NASC -Naval Air Systems Command
NOSIH -Naval Ordnance Station, Indian Head
NWC -Naval Weapons Center
PMTC -Pacific Missile Test Center
TI -Texas Instruments
USAF -United States Air Force
USMC -United States Marine Corps
USN -United States Navy

DEPARTMENT OF DEFENSE OUTLAYS FOR MISSILE PROCUREMENT[a]

By Agency
Fiscal Years 1962-1990
(Millions of Dollars)

Year	TOTAL MISSILE PROCUREMENT[a]	Air Force	Navy[a]	Army
1962	$3,442	$2,385	$593	$464
1963	3,817	2,676	718	423
1964	3,577	2,100	981	496
1965	2,096	1,320	522	254
1966	2,069	1,313	512	244
1967	1,930	1,278	432	220
1968	2,219	1,388	436	395
1969	2,509	1,382	534	593
1970	2,912	1,467	702	743
1971	3,140	1,497	791	852
1972	3,009	1,334	831	844
1973	3,023	1,454	628	941
1974	2,981	1,537	541	903
1975	2,889	1,602	615	672
1976	2,296	1,549	584	163
Tr.Qtr.	402	347	148	(93)
1977	2,781	1,501[r]	905	374
1978	3,096	1,376	1,302	418
1979	3,786	1,537	1,702	547
1980	4,434	1,810	1,973	651
1981	5,809	2,366[r]	2,297	1,146
1982	6,782	3,069	2,444	1,269
1983	7,795	3,383	2,812	1,600
1984	9,527	4,640	2,809	2,079
1985	10,749	5,409	2,941	2,399
1986	11,731	6,473	2,780	2,478
1987	11,473	6,002	3,157	2,314
1988	11,676	6,046	3,392	2,239
1989[E]	13,370	7,307	3,770	2,292
1990[E]	13,757	7,279	4,217	2,261

Source: Department of Defense Budget (Annually).

NOTE: Detail may not add to totals because of rounding.

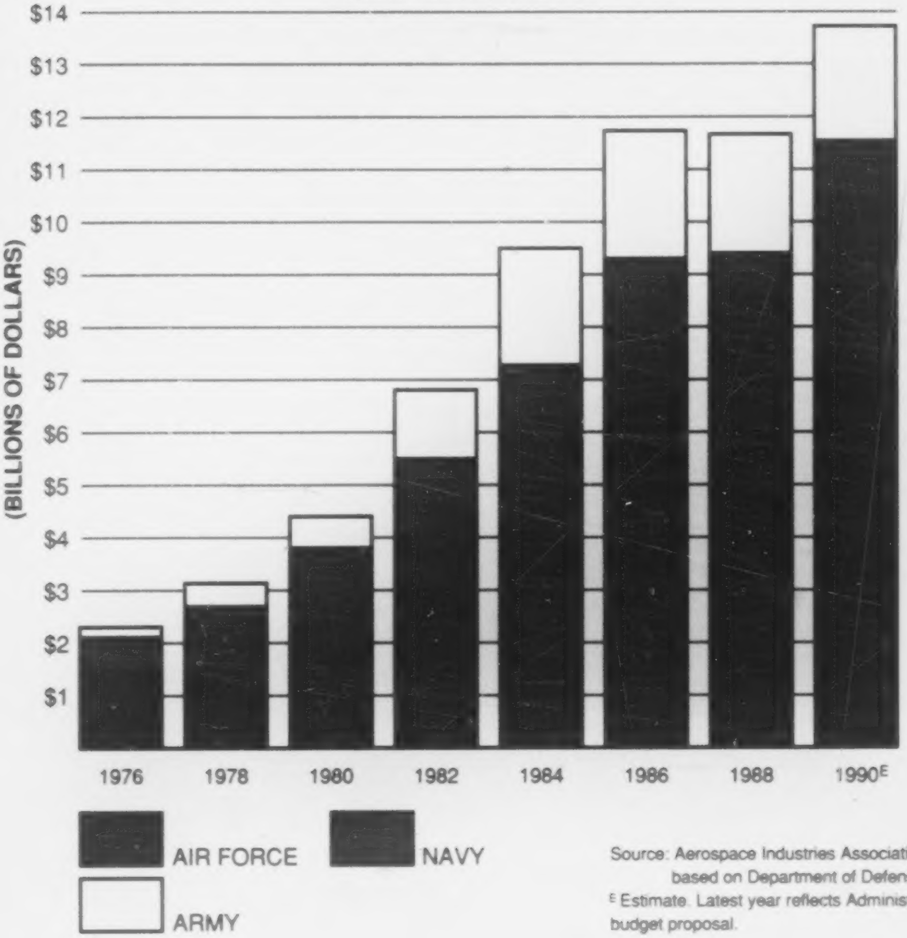
[a] Revised by AIA from previously published data to include Navy Weapons Procurement in Total Missile Procurement. Beginning 1978, DOD combined Navy Missile Procurement with torpedoes and other related products into Navy Weapons Procurement. Missiles comprise approximately 80 percent of the value of this category.

[E] Estimate. Latest year reflects Administration's budget proposal.

Tr.Qtr. Transition quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. Beginning October 1, 1976, the fiscal years run from October 1 through September 30. A three-month "Transition Quarter" from July 1 through September 30, 1976 belongs to neither fiscal year.

DEPARTMENT OF DEFENSE OUTLAYS FOR MISSILE PROCUREMENT

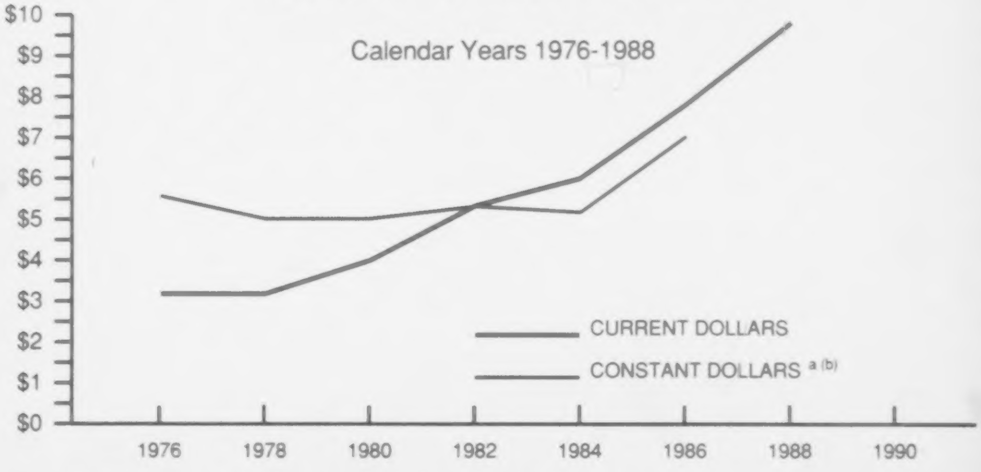
By Agency
Fiscal Years 1976-1990



Source: Aerospace Industries Association based on Department of Defense Budget.

E Estimate. Latest year reflects Administration's budget proposal.

SALES OF MISSILE SYSTEMS & PARTS



Source: Aerospace Industries Association based on Bureau of Census data.

a Based on revised aerospace composite deflator (1982 = 100).

b Aerospace composite deflator for 1988 not available.

ORDERS, SALES, AND BACKLOG MISSILE SYSTEMS AND PARTS[a]

Calendar Years 1974-1988
(Millions of Dollars)

Year	SALES-Current Dollars	SALES-Constant Dollars[c]
1974	$3,454	$7,318
1975	3,548	6,694
1976	3,237	5,581
1977	3,118	5,021
1978	3,264[b]	4,991
1979	3,706	5,126
1980	3,971	4,945
1981	4,662	5,157
1982	5,676	5,676
1983	5,991	5,711
1984	6,094	5,364[r]
1985	7,975	7,102[r]
1986	8,236	7,149[r]
1987	9,528	8,351
1988	9,485	NA

Year	NET NEW ORDERS	BACKLOG AS OF DECEMBER 31
1974	$4,059	$4,473
1975	3,655	4,580
1976	3,036	4,379
1977	3,280	4,541
1978	2,948	4,581
1979	3,724	4,916
1980	4,961	5,558
1981	6,030	6,749
1982	6,034	7,107
1983	7,231	8,406
1984	7,731	10,043
1985	8,122	10,190
1986	11,023	12,754
1987	11,652	14,625
1988	9,437	14,255

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

[a] Prior to 1980, includes space vehicle systems and parts sold to other than U.S. Government customers.

[b] AIA estimate based on MQ37D.

[c] Based on revised aerospace composite price deflator (1982 = 100).

NA Aerospace composite price deflators are no longer available from the U.S. Department of Commerce. Work is underway to construct new deflators representative of the industry.

[r] Revised.

ORDERS, SALES, AND BACKLOG ENGINES AND PROPULSION UNITS FOR MISSILES AND SPACE VEHICLES[a]

Calendar Years 1973-1987
(Millions of Dollars)

Year	SALES-Current Dollars			SALES-Constant Dollars[c]		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1974	$ 649	$ 633	$ 16	$1,375	$1,341	$ 34
1975	643	626	17	1,213	1,181	32
1976	641	621	20	1,105	1,071	34
1977	787	757	30	1,267	1,219	48
1978	792	760	32	1,211	1,162	49
1979	952	915	37	1,317	1,266	51
1980	939	661	278	1,169	823	346
1981	1,204	786	418	1,332	869	462
1982	1,555	899	656	1,555	899	656
1983	1,814	951	863	1,729	907	823
1984	2,305	1,116	1,189	2,029[r]	982[r]	1,047[r]
1985	2,466	1,256	1,210	2,196[r]	1,118[r]	1,078[r]
1986	2,995	1,778	1,217	2,600[r]	1,543[r]	1,057[r]
1987	2,993	1,563	1,430	2,623	1,370	1,253
1988	3,407	1,830	1,577	NA	NA	NA

Year	NET NEW ORDERS			BACKLOG AS OF DECEMBER 31		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1974	$ 702	$ 680	$ 22	$ 678	$ 662	$ 16
1975	496	481	15	531	517	14
1976	783	763	20	673	659	14
1977	727	693	34	613	595	18
1978	967	919	48	788	754	34
1979	1,187	1,141	46	1,024	980	44
1980	1,121	653	568	1,284	871	413
1981	1,284	746	538	1,343	828	515
1982	2,112	1,134	978	1,901	1,063	838
1983	1,618	942	676	1,691	1,052	639
1984	3,770	2,258	1,512	3,156	2,194	962
1985	3,823	1,323	2,500	4,513	2,261	2,252
1986	1,985	1,224	761	3,503	1,689	1,814
1987	3,335	1,995	1,340	3,849	2,121	1,728
1988	3,507	1,623	1,884	3,985	1,998	1,987

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

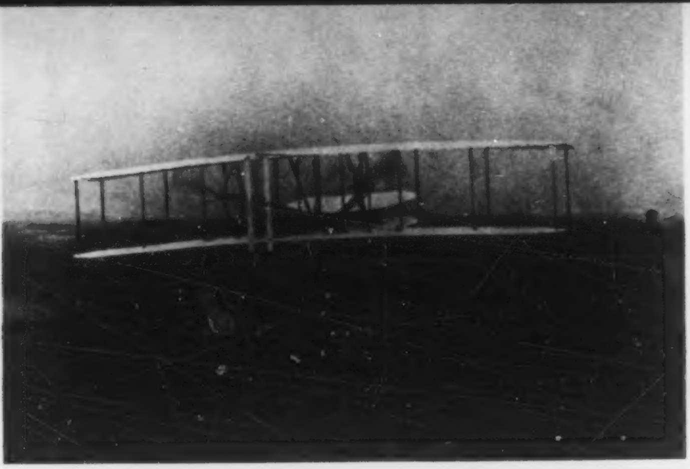
[a] See table in Space Programs Chapter for Orders, Sales, and Backlog, Space Vehicle Systems.

[b] Prior to 1980 includes figures for nonmilitary U.S. Government customers.

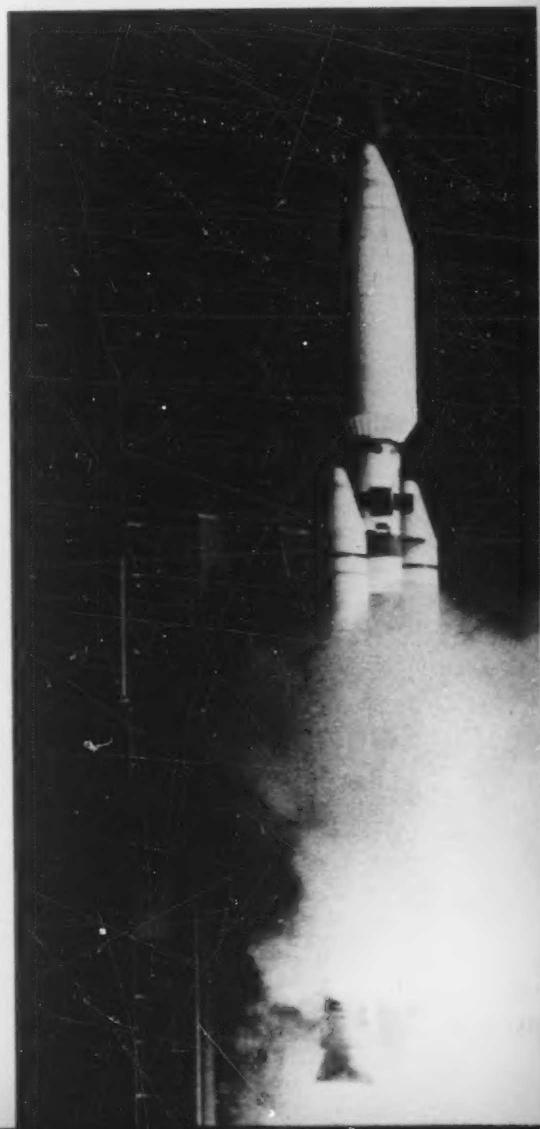
[c] Based on revised aerospace composite price deflator (1982 = 100).

NA Aerospace composite price deflators are no longer available from the U.S. Department of Commerce. Work is underway to construct new deflators representative of the industry.

[r] Revised.



Space Programs



The upward trend in industry sales of space equipment, which has been on a steady rise since the mid-1970s, reached an all-time peak in 1988.

Aerospace Industries Association data showed sales of space systems and related equipment at $24.3 billion, an increase of approximately 9 percent over the 1987 figure of $22.3 billion. Space sales accounted for more than 21 percent of total sales and space continued to rank second among product groups, behind military aircraft but ahead of civil aircraft.

A different measure of aerospace industry space activity is supplied by Bureau of the Census data, which cover both military and civil sales of spacecraft, space systems and launch vehicle components exclusive of propulsion units. Since propulsion systems represent a major element of space vehicle cost, the data serve as general trend indicators rather than an expression of industry activity level.

Census reported calendar year 1988 space sales of $8.6 billion, a gain of about 11 percent over the 1987 figure of $7.7 billion.

Census also reported a sharp drop in net new orders for space vehicle systems, again excluding propulsion units. Orders received during 1988 totaled $7.3 billion, down from $11.2 billion in the previous year. The total was compounded of a major decline in military orders and a minor gain in non-military orders. Military orders amounted to $4.6 billion, down from $8.7 billion in 1987; non-military orders increased from $2.5 billion in 1987 to $2.7 billion in 1988.

As reported by Census, the industry's space backlog (once more excluding propulsion) as of yearend 1988 was $10.8 billion, down from $11.8 billion a year earlier.

A major event of the military space year 1988 was the highly successful Delta 181 mission in February, a Strategic Defense Initiative project intended to test the detection and discriminatory capabilities of a wide range of sensory devices. In November, the USAF launched the last of its Titan 34D boosters with a classified payload on board; the successor Titan IV heavy lift launch vehicle was being readied for 1989 introduction to service. Among other 1988 Department of Defense launches were one Defense Meteorological System Program (DMSP) satellite, giving the USAF two operational DMSP spacecraft, and three Navy Transit Navigation Satellites.

The highlight of the civil space year 1988 was the resumption of Space Shuttle operations after a 32-month hiatus with the September 29 launch of the Shuttle Orbiter *Discovery* on NASA mission STS-26. The principal activity on the four-day flight was the successful deployment of the second of three TDRS (Tracking and Data Relay Satellite) spacecraft (the third was sent into orbit in 1989).

On December 2, NASA followed up with the second Shuttle launch of the year, Orbiter *Atlantis* on mission STS-27 involving delivery to orbit of a classified military payload.

The principal DoD space-related program in 1988-89 was the Strategic Defense Initiative (SDI), funded at $3.6 billion in Fiscal Year 1989 with a planned increase to $5.6 billion in FY 1990; heavy Congressional cuts in the SDI budget proposal, not finalized at publication time, indicated that SDI's 1990 funding would be in the neighborhood of $4 billion.

Other major DoD programs, excluding classified projects, include the continuing Defense Meteorological Satellite program, involving periodic replacement of the current Block 5 satellites in the 1990s and development of an advanced Block 6 version; the Defense Satellite Communications System, also a continuing series being developed in advanced versions; the specialized fleet Satellite Communications program; the Navstar Global Positioning System for satellite-aided precision location of air, sea and land vehicles; and the Advanced Launch System, a heavy lift booster targeted for service in the late 1990s.

NASA's major space program in 1988-89 was Space Station *Freedom*, expected to be funded in FY 1990 at something between $1.65 billion and $1.85 billion (the House/Senate figures awaiting conference resolution at publication time). Funding of that order would permit maintenance of NASA's schedule that calls for start of assembly-in-orbit operations in 1995 and full operational status in 1998.

Among unmanned NASA systems planned for launch in the 1990s were the Hubble Space Telescope, first of the Great Observatory series; the Gamma Ray Observatory, second of that series; Ulysses, a joint NASA/European Space Agency project that will undertake a multiyear mission out of the plane of the ecliptic; the Mars Observer, destined to become a man-made moon of Mars reporting high resolution data over a long period; the Advanced X-Ray Astrophysics Facility, third of the Great Observatories; the Ocean Topography Experiment (TOPEX), a remote sensing ocean observation system; and the NASA/ESA International Solar Terrestrial Physics program involving multiple spacecraft studying the physical processes that link Earth and the Sun.

U.S. SPACECRAFT RECORD[a]

Calendar Years 1957-1988

Year	Earth Orbit[b]		Earth Escape[b]	
	Success	Failure	Success	Failure
1957	0	1	0	0
1958	5	8	0	4
1959	9	9	1	2
1960	16	12	1	2
1961	35	12	0	2
1962	55	12	4	1
1963	62	11	0	0
1964	69	8	4	0
1965	93	7	4	1
1966	94	12	7	1[c]
1967	78	4	10	0
1968	61	15	3	0
1969	58	1	8	1
1970	36	1	3	0
1971	45	2	8	1
1972	33	2	8	0
1973	23	2	3	0
1974	27	2	1	0
1975	30	4	4	0
1976	33	0	1	0
1977	27	2	2	0
1978	34	2	7	0
1979	18	0	0	0
1980	16	4	0	0
1981	20	1	0	0
1982	21	0	0	0
1983	31	0	0	0
1984	35	3	0	0
1985	37	1	0	0
1986	11	4	0	0
1987	8	1	0	0
1988	8	0	0	0
TOTAL	1,128	143	79	15

Source: NASA, "Aeronautics and Space Report of the President," (Annually).

[a] Payloads, rather than launchings; some launches account for multiple spacecraft. Includes spacecraft from cooperating countries launched by U.S. launch vehicles.

[b] The criterion of success or failure used is attainment of earth orbit or earth escape rather than judgment of mission success. "Escape" flights include all that were intended to go at least an altitude equal to lunar distance from the earth.

[c] This earth-escape failure did attain earth orbit and therefore is included in the earth-orbit success totals.

WORLDWIDE SPACE LAUNCHINGS WHICH ATTAINED EARTH ORBIT OR BEYOND[a]

Calendar Years 1957-1988

Country	Total 1957-1988	1984	1985	1986	1987	1988
TOTAL	3,088	129	121	103	110	112
U.S.S.R.	2,017	97	98	91	95	90
United States	875	22	17	6	8	8
Japan	36	3	2	2	3	2
People's Republic of China	23	3	1	2	2	4
European Space Agency	23	4	3	2	2	7
India	3	—	—	—	—	—
Other[b]	20	—	—	—	—	—

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).

[a] Number of launchings rather than spacecraft; some launches orbited multiple spacecraft.

[b] Includes 10 by France, 8 by Italy (5 were U.S. spacecraft), 1 by Australia, and 1 by the United Kingdom.

U.S. SPACE LAUNCH VEHICLES

As of 1988

Vehicle and Initial Launch & First Launch of this Modification	Stages	Thrust (Kilo-newtons)	Maximum Payload (Kg)^{a} 185-Km Orbit	Maximum Payload (Kg)^{a} Geo-synch.-Transfer Orbit	Maximum Payload (Kg)^{a} Circular Sun-Synch. Orbit
Scout (1960; 1979)	1. Algol IIIA* 2. Castor IIA* 3. Antares IIIA* 4. Altair IIIA*	431.1 285.2 83.1 25.6	255 205^{b}	—	155^{b}
Delta 2900 Series (Thor-Delta) (1960; 1973)	1. Thor plus 9 TX 354-5* 2. Delta 3. TE 364-4*	912.0 147^{c} 44.2 65.8	2,000 1,410^{b}	705	1,250^{b}
Delta 3900 Series (Thor-Delta)^{d} (1960; 1982)	1. Thor plus 9 TX 526-2* 2. Delta	912.0 375^{c} 44.2	3,045 2,180^{b}	1,275	2,135^{b}
Atlas E (1967; 1972)	1. Atlas booster & sustainer	1,722.0	2,090^{b,e}	—	1,500^{b}
Atlas-Centaur (1962; 1984)	1. Atlas booster & sustainer 2. Centaur	1,913.0 146.0	6,100	2,360^{f}	—

Vehicle and Launch Date	Stages	Thrust (Kilo-newtons)	Maximum Payload (Kg)^{a} 185-Km Orbit	Maximum Payload (Kg)^{a} Direct Geo-synch Orbit	Maximum Payload (Kg)^{a} Sun-Synch. Transfer Orbit
Titan IIIB-Agena (1966)	1. LR-87 2. LR-91 3. Agena	2,341.0 455.1 71.2	3,600^{b}	—	3,060^{b}

(Continued on next page)

U.S. SPACE LAUNCH VEHICLES

As of 1988 (Continued)

Vehicle and Launch Date	Stages	Thrust (Kilonewtons)	Maximum Payload (Kg)[a] 185-Km Orbit	Direct Geo.-Synch. Orbit	Sun Synch. Transfer Orbit
Titan III(34)D/ IUS (1982)	1. Two 5½-segment 3.05-m. dia*	11,564.8	14,920	1,850[b]	—
	2. LR-87	2,366.3			
	3. LR-91	449.3			
	4. IUS 1st stage*	275.8			
	5. IUS 2nd stage*	115.7			
Titan III(34)D/ Transtage (1984)	1. Two 5½-segment 3.05-m. dia*	11,564.8	14,920	1,850[b]	—
	2. LR-87	2,366.3			
	3. LR-91	449.3			
	4. Transtage	69.8			
Space Shuttle (reusable) (1981)	1. Orbiter; 3 main engines (SSMEs) fire in parallel with SRBs	1,670[c]	29,500 in full performance configuration (280-420 km orbit)		
	2. Two solid-fueled rocket boosters (SRBs) mounted on external tank (ET) fire in parallel with SSMEs	11,790[c]			

Source: NASA, "Aeronautics and Space Report of the President" (Annually) and NASA Historian's office.

* Solid propellant; all others are liquid.

[a] Due east launch except as indicated.

[b] Polar launch.

[c] Each.

[d] Maximum performance based on 3920 and 3920/PAM (payload assist module) configurations.

[e] With dual TE 364-4.

[f] 96° flight azimuth.

ORDERS, SALES, AND BACKLOG SPACE VEHICLE SYSTEMS

(Excluding Engines and Propulsion Units)[a]
Calendar Years 1974-1988
(Millions of Dollars)

Year	SALES-Current Dollars			SALES-Constant Dollars[c]		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1974	$1,751	$ 944	$ 807	$3,710	$2,000	$1,710
1975	2,119	1,096	1,023	3,998	2,068	1,930
1976	2,002	904	1,098	3,452	1,559	1,893
1977	1,870	814	1,056	3,011	1,311	1,700
1978	2,324	1,006	1,318	3,554	1,538	2,015
1979	2,539	1,105	1,434	3,512	1,528	1,983
1980	3,483	1,461	2,022	4,337	1,819	2,518
1981	3,856	1,736	2,120	4,265	1,920	2,345
1982	4,749	2,606	2,143	4,749	2,606	2,143
1983	4,940	2,420	2,520	4,709	2,307	2,402
1984	5,225	3,019	2,206	4,599[r]	2,658[r]	1,942[r]
1985	6,300	4,241	2,059	5,610[r]	3,777[r]	1,833[r]
1986	6,304	4,579	1,725	5,472[r]	3,975[r]	1,497[r]
1987	7,746	5,325	2,421	6,789	4,667	2,122
1988	8,622	6,190	2,432	NA	NA	NA

Year	NET NEW ORDERS			BACKLOG AS OF DECEMBER 31		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1974	$2,066	$1,152	$ 914	$1,492	$1,131	$ 361
1975	1,931	984	947	1,304	1,019	285
1976	1,932	787	1,145	1,234	902	332
1977	2,225	1,175	1,050	1,589	1,263	326
1978	3,157	1,436	1,721[E]	2,188	1,693	495
1979	2,698	1,018	1,680	1,448	909	539
1980	3,636	1,625	2,011	2,099	1,218	881
1981	5,062	2,878	2,184	3,163	2,166	997
1982	5,842	2,718	3,124	4,254	2,277	1,977
1983	5,399	3,016	2,383	4,865	2,733	2,132
1984	4,984	3,385	1,599	4,624	3,099	1,525
1985	8,383	6,083	2,300	6,707	4,941	1,766
1986	7,437	5,666	1,771	8,063	6,028	2,035
1987	11,199	8,654	2,545	11,785	9,036	2,749
1988	7,296	4,561	2,735	10,838	7,880	2,958

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

[a] See table in Missile Program Chapter for Orders, Sales, and Backlog, Engine and Propulsion Units for Missiles and Space Vehicles.

[b] Space vehicle systems and parts sold to other than U.S. Government customers included as of 1980; previously, this product group combined with missile systems and parts.

[c] Based on revised aerospace composite price deflator (1982 = 100); detail may not add to totals because of rounding.

NA Aerospace composite price deflators are no longer available from the U.S. Department of Commerce. Work is underway to construct new deflators representative of the industry.

[E] AIA estimate based on MQ37D data.

[r] Revised.

FEDERAL SPACE ACTIVITIES OUTLAYS

Fiscal Years 1961-1988
(Millions of Current Dollars)

Year	TOTAL	NASA[a]	DOD	Energy	Commerce	Other[b]
1961	$ 1,467.9	$ 693.6	$ 710.0	$ 64.3	$ —	$ —
1962	2,386.6	1,225.9	1,028.8	130.0	1.0	0.9
1963	4,078.6	2,516.8	1,367.5	181.0	12.2	1.1
1964	5,929.8	4,131.3	1,563.5	220.1	12.3	2.6
1965	6,886.1	5,035.0	1,591.8	232.2	24.1	3.0
1966	7,718.5	5,857.9	1,637.4	188.3	28.1	6.8
1967	7,237.3	5,336.7	1,673.1	183.6	38.6	5.3
1968	6,666.7	4,595.3	1,890.2	146.5	29.0	5.7
1969	6,326.1	4,078.0	2,095.0	117.5	31.0	4.6
1970	5,453.2	3,565.2	1,756.1	102.6	24.0	5.3
1971	4,999.0	3,171.0	1,693.0	97.3	29.8	7.9
1972	4,771.8	3,194.9	1,470.0	59.6	37.4	9.9
1973	4,719.4	3,069.4	1,557.0	51.1	29.4	12.5
1974	4,853.9	2,960.4	1,777.0	38.8	64.0	13.7
1975	4,890.8	2,950.9	1,831.1	34.3	63.6	10.9
1976	5,313.9	3,336.3	1,864.4	25.7	71.1	16.4
Tr. Qtr.	1,361.0	868.6	458.1	7.5	23.2	3.6
1977	5,559.1	3,599.5	1,832.7	22.2	86.9	17.8
1978	6,188.2	3,582.4	2,457.0	28.6	100.7	19.5
1979	6,808.3	3,743.9	2,891.8	54.7	97.4	20.5
1980	7,667.7	4,340.1	3,162.3	48.8	88.7	27.8
1981	9,165.5	4,877.1	4,130.5	46.9	81.0	30.0
1982	10,466.2	5,463.3	4,771.5	59.5	142.4	29.5
1983	12,590.4	6,100.9	6,246.7	39.6	178.0	25.2
1984	14,726.1	6,461.4	8,000.2	33.4	208.7	22.4
1985	17,254.8	6,607.4	10,441.3	34.0	155.4	16.7
1986	18,581.0	6,756.0	11,448.5	34.7	316.9	24.9
1987[E]	21,878.7	7,254.0	14,252.2	47.3	299.2	26.0
1988[E]	24,680.0	8,851.0	15,395.8	90.3	316.1	26.8

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
NOTE: Detail may not add to totals because of rounding.
[a] Excludes amounts for air transportation.
[b] Departments of Interior and Agriculture, and The National Science Foundation. NSF funding transferred to NASA after 1982.
[E] Estimate. Latest year reflects Administration's budget proposal.

FEDERAL SPACE ACTIVITIES OUTLAYS IN CONSTANT DOLLARS

Fiscal Years 1961-1988
(Millions of Constant Dollars, 1982 = 100[a])

Year	TOTAL	NASA[b]	DOD	Energy	Commerce	Other[c]
1961	$ 4,668.9	$ 2,206.1	$2,258.3	$204.5	$ —	$ —
1962	7,458.1	3,830.9	3,215.0	406.3	3.1	2.8
1963	12,518.7	7,725.0	4,197.4	555.6	37.4	3.4
1964	17,941.9	12,500.2	4,730.7	666.0	37.2	7.9
1965	20,397.2	14,914.1	4,715.0	687.8	71.4	8.9
1966	22,217.9	16,862.1	4,713.3	542.0	80.9	19.6
1967	20,142.8	14,853.0	4,656.6	511.0	107.4	14.8
1968	17,926.1	12,356.3	5,082.5	393.9	78.0	15.3
1969	16,138.0	10,403.1	5,344.4	299.7	79.1	11.7
1970	13,146.6	8,595.0	4,233.6	247.3	57.9	12.8
1971	11,449.8	7,262.9	3,877.7	222.9	68.3	18.1
1972	10,360.0	6,936.4	3,191.5	129.4	81.2	21.5
1973	9,760.9	6,348.3	3,220.3	105.7	60.8	25.9
1974	9,305.8	5,675.6	3,406.8	74.4	122.7	26.3
1975	8,502.8	5,130.2	3,183.4	59.6	110.6	18.9
1976	8,559.8	5,374.2	3,003.2	41.4	114.5	26.4
Tr. Qtr.	2,108.3	1,345.5	709.6	11.6	35.9	5.6
1977	8,293.5	5,370.0	2,734.1	33.1	129.6	26.6
1978	8,628.3	4,995.0	3,425.8	39.9	140.4	27.2
1979	8,739.8	4,806.0	3,712.2	70.2	125.0	26.3
1980	9,048.5	5,121.7	3,731.8	57.6	104.7	32.8
1981	9,832.1	5,231.8	4,430.9	50.3	86.9	32.2
1982	10,466.2	5,463.3	4,771.5	59.5	142.4	29.5
1983[r]	12,079.4	5,853.3	5,993.2	38.0	170.8	24.2
1984[r]	13,611.3	5,972.3	7,394.6	30.9	192.9	20.7
1985[r]	15,448.8	5,915.8	9,348.5	30.4	139.1	15.0
1986	16,177.1	5,881.9	9,967.4	30.2	275.9	21.7
1987[E]	18,544.4	6,148.5	12,080.2	40.1	253.6	22.0
1988[E]	20,171.6	7,234.2	12,583.4	73.8	258.4	21.9

Source: AIA, derived from NASA, "Aeronautics and Space Report of the President" (Annually).
NOTE: Detail may not add to totals because of rounding.

a Based on fiscal year GNP implicit price deflator.
b Excludes amounts for air transportation.
c Departments of Interior and Agriculture, and The National Science Foundation. NSF funding transferred to NASA after 1982.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.

FEDERAL SPACE ACTIVITIES BUDGET AUTHORITY

Fiscal Years 1961-1988[a]
(Millions of Current Dollars)

Year	TOTAL	NASA[a]	DOD	Energy	Commerce	Other[b]
1961	$ 1,808	$ 926	$ 814	$ 68	$ —	$ 1
1962	3,295	1,797	1,298	148	51	1
1963	5,435	3,626	1,550	214	43	2
1964	6,831	5,016	1,599	210	3	3
1965	6,956	5,138	1,574	229	12	3
1966	6,970	5,065	1,689	187	27	3
1967	6,710	4,830	1,664	184	29	3
1968	6,529	4,430	1,922	145	28	4
1969	5,976	3,822	2,013	118	20	3
1970	5,341	3,547	1,678	103	8	4
1971	4,741	3,101	1,512	95	27	5
1972	4,575	3,071	1,407	55	31	10
1973	4,825	3,093	1,623	54	40	15
1974	4,640	2,759	1,766	42	60	14
1975	4,914	2,915	1,892	30	64	13
1976	5,320	3,225	1,983	23	72	16
Tr. Qtr.	1,341	849	460	5	22	4
1977	5,983	3,440	2,412	22	91	18
1978	6,518	3,623	2,738	34	103	20
1979	7,244	4,030	3,036	59	98	21
1980	8,689	4,680	3,848	40	93	28
1981	9,978	4,992	4,828	41	87	30
1982	12,441	5,528	6,679	61	145	29
1983	15,589	6,328	9,019	39	178	25
1984	17,136	6,648	10,195	34	236	22
1985	20,167	6,925	12,768	34	423	17
1986	21,659	7,165	14,126	35	309	25
1987[E]	25,876	9,809	15,717	47	277	26
1988[E]	26,409	8,756	17,196	90	340	27

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
Note: Detail may not add to totals because of rounding.
[a] Excludes amounts for air transportation.
[b] Departments of Interior and Agriculture, and the National Science Foundation. NSF funding transferred to NASA after 1982.
[E] Estimate. Latest year reflects Administration's budget proposal.

FEDERAL SPACE ACTIVITIES BUDGET AUTHORITY IN CONSTANT DOLLARS

Fiscal Years 1961-1988
(Millions of Constant Dollars, 1982 = 100[a])

Year	TOTAL	NASA[b]	DOD	Energy	Commerce	Other[c]
1961	$ 5,751	$ 2,945	$ 2,589	$216	$ —	$ 3
1962	10,297	5,616	4,056	463	159	3
1963	16,682	11,130	4,758	657	132	6
1964	20,669	15,177	4,838	635	9	9
1965	20,604	15,219	4,662	678	36	9
1966	20,063	14,580	4,862	538	78	9
1967	18,675	13,443	4,631	512	81	8
1968	17,556	11,912	5,168	390	75	11
1969	15,245	9,750	5,135	301	51	8
1970	12,876	8,551	4,045	248	19	7
1971	10,859	7,103	3,463	218	62	11
1972	9,933	6,667	3,055	123	67	22
1973	9,979	6,397	3,357	112	83	31
1974	8,896	5,289	3,386	81	115	27
1975	8,543	5,068	3,289	52	111	23
1976	8,570	5,195	3,194	37	116	26
Tr. Qtr.	2,077	1,315	713	8	34	6
1977	8,926	5,132	3,598	33	136	27
1978	9,088	5,052	3,818	47	144	28
1979	9,299	5,173	3,897	76	126	27
1980	10,254	5,523	4,541	47	110	33
1981	10,704	5,355	5,179	44	93	32
1982	12,441	5,528	6,679	61	145	29
1983[r]	14,956	6,071	8,653	37	171	24
1984[r]	15,839	6,145	9,423	31	218	20
1985[r]	18,056	6,200	11,432	30	379	15
1986	18,857	6,238	12,298	30	269	22
1987[E]	21,933	8,314	13,322	40	235	22
1988[E]	21,585	7,157	14,055	74	278	22

Source: AIA, derived from NASA, "Aeronautics and Space Report of the President," (Annually).

[a] Based on fiscal year GNP implicit price deflator.

[b] Excludes amounts for air transportation.

[c] Departments of Interior and Agriculture, and The National Science Foundation. NSF funding transferred to NASA after 1982.

[E] Estimate. Latest year reflects Administration's budget proposal.

[r] Revised.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY

Fiscal Years 1963-1990
(Millions of Current Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1963	$3,673	$2,929	$744	$ (a)
1964	5,099	3,890	713	496
1965	5,250	4,360	267	623
1966	5,175	4,502	61	602
1967	4,968	4,235	85	648
1968	4,589	3,912	38	639
1969	3,995	3,314	33	648
1970	3,749	2,993	53	703
1971	3,312	2,556	26	730
1972	3,308	2,523	53	732
1973	3,408	2,599	79	730
1974	3,040	2,194	101	745
1975	3,231	2,323	143	765
1976	3,552	2,678	82	792
Tr.Qtr.	932	700	11	221
1977	3,819	2,856	118	845
1978	4,064	3,012	162	890
1979	4,559	3,477	148	934
1980	5,243	4,088	159	996
1981	5,522	4,334	117	1,071
1982	6,020	4,772	114	1,134
1983	6,875	5,539	139	1,197

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984	$7,316	$2,064	$3,772	$223	$1,256
1985	7,573	2,468	3,594	178	1,332
1986	7,807	2,619	3,670	176	1,342
1987	10,923	3,154	6,100	217	1,453
1988	9,062	3,280	3,806	213	1,763
1989[E]	10,954	4,242	4,561	275	1,892
1990[E]	13,148	5,752	5,013	342	2,032

Source: "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Included in Research and Development for one year.
E Estimate. Latest year reflects Administration's budget proposal.
Tr.Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. Beginning October 1, 1976 the fiscal years run from October 1 through September 30. A three-month "Transition Quarter" from July 1 through September 30, 1976 belongs to neither fiscal year.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY IN CONSTANT DOLLARS

Fiscal Years 1963-1990
(Millions of Dollars 1982 = 100[a])

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1963	$11,274	$8,990	$2,284	$ (b)
1964	15,428	11,770	2,157	1,501
1965	15,551	12,915	791	1,845
1966	14,896	12,959	176	1,733
1967	13,827	11,787	237	1,804
1968	12,339	10,519	102	1,718
1969	10,191	8,454	84	1,653
1970	9,038	7,216	128	1,695
1971	7,586	5,854	60	1,672
1972	7,182	5,478	115	1,589
1973	7,049	5,375	163	1,510
1974	5,828	4,206	194	1,428
1975	5,617	4,039	249	1,330
1976	5,722	4,314	132	1,276
Tr.Qtr.	1,444	1,084	17	342
1977	5,697	4,261	176	1,261
1978	5,666	4,200	226	1,241
1979	5,852	4,463	190	1,199
1980	6,187	4,824	188	1,175
1981	5,924	4,649	126	1,149
1982	6,020	4,772	114	1,134
1983	6,596	5,314	133	1,148

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984	$6,762	$1,908	$3,486	$206	$1,161
1985[r]	6,790	2,213	3,222	160	1,194
1986[r]	7,004	2,350	3,293	158	1,204
1987[r]	9,238	2,667	5,159	184	1,229
1988	7,430	2,689	3,121	175	1,446
1989[E]	8,637	3,345	3,596	217	1,492
1990[E]	10,004	4,376	3,814	260	1,546

Source: AIA, derived from "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Based on fiscal year GNP implicit price deflator.
b Included in Research and Development for one year.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.
Tr.Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. Beginning October 1, 1976, the fiscal years run from October 1 through September 30. A three-month "Transition Quarter" from July 1 through September 30, 1976 belongs to neither fiscal year.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OUTLAYS

Fiscal Years 1963-1990
(Millions of Current Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1963	$2,552	$1,912	$225	$416
1964	4,171	3,317	438	416
1965	5,093	3,984	531	578
1966	5,933	4,741	573	619
1967	5,426	4,487	289	650
1968	4,724	3,946	126	652
1969	4,251	3,530	65	656
1970	3,753	2,992	54	707
1971	3,382	2,630	44	708
1972	3,422	2,623	50	749
1973	3,315	2,541	45	729
1974	3,256	2,421	75	760
1975	3,266	2,420	85	761
1976	3,669	2,749	121	799
Tr.Qtr.	952	731	26	195
1977	3,945	2,980	105	860
1978	3,983	2,989	124	870
1979	4,196	3,139	133	925
1980	4,852	3,702	140	1,010
1981	5,426	4,228	147	1,050
1982	6,035	4,796	109	1,130
1983	6,664	5,316	108	1,240

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984	$7,048	$2,792	$2,915	$109	$1,232
1985	7,251	2,118	3,707	170	1,322
1986	7,403	2,615	3,267	189	1,332
1987	7,591	2,436	3,597	149	1,409
1988	9,092	2,916	4,362	166	1,648
1989^{E}	10,596	3,718	4,835	169	1,889
1990^{E}	12,597	4,974	5,365	237	2,012

Source: "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
E Estimate. Latest year reflects Administration's budget proposal
Tr.Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. Beginning October 1,1976, the fiscal years run from October 1 through September 30. A three-month "Transition Quarter" from July 1 through September 30, 1976 belongs to neither fiscal year.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OUTLAYS IN CONSTANT DOLLARS

Fiscal Years 1963-1990
(Millions of Constant Dollars, 1982 = 100[a])

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1963	$7,833	$5,869	$ 691	$1,277
1964	12,620	10,036	1,325	1,259
1965	15,086	11,801	1,573	1,712
1966	17,078	13,647	1,649	1,782
1967	15,102	12,488	804	1,809
1968	12,702	10,610	339	1,753
1969	10,844	9,005	166	1,673
1970	9,048	7,213	130	1,704
1971	7,746	6,024	101	1,622
1972	7,429	5,695	109	1,626
1973	6,856	5,255	93	1,508
1974	6,242	4,641	144	1,457
1975	5,678	4,207	148	1,323
1976	5,910	4,428	195	1,287
Tr.Qtr.	1,474	1,132	40	302
1977	5,885	4,446	157	1,283
1978	5,553	4,168	173	1,213
1979	5,386	4,030	171	1,187
1980	5,726	4,369	165	1,192
1981	5,821	4,536	158	1,126
1982	6,035	4,796	109	1,130
1983	6,394	5,100	104	1,190

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984	$6,514	$2,581	$2,694	$101	$1,139
1985[r]	6,501	1,899	3,324	152	1,185
1986[r]	6,461	2,282	2,851	165	1,163
1987[r]	6,420	2,060	3,042	126	1,192
1988	7,455	2,391	3,577	136	1,351
1989[E]	8,355	2,932	3,812	133	1,490
1990[E]	9,585	3,785	4,082	180	1,531

Source: AIA, derived from "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
[a] Based on fiscal year GNP implicit price deflator.
[E] Estimate. Latest year reflects Administration's budget proposal.
[r] Revised.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY FOR RESEARCH AND DEVELOPMENT AND SPACE FLIGHT, CONTROL & DATA COMMUNICATIONS

Fiscal Years 1989-1990
(Millions of Dollars)

	1989^E	1990^E
RESEARCH AND DEVELOPMENT—TOTAL	**$4,267**	**$5,752**
Space Station—Total	900	2,050
Space Transport Capability Development—Total	681	639
Space Science & Applications—Total	1,830	1,995
Physics and Astronomy	734	895
Planetary Exploration	417	397
Life Sciences	78	124
Space Applications	601	580
Commercial Use of Space—Total	45	61
Aeronautics & Space Technology—Total	769	928
Aeronautical Research & Technology	404	463
Space Research & Technology	296	338
Transatmospheric Research & Technology	69	127
Safety,Reliability & Quality Assurance—Total	22	23
Tracking & Data Advanced Systems—Total	19	20
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS—TOTAL	4,464	5,140
Space Shuttle Production & Capability Development—Total	1,128	1,305
Orbiter	282	237
Launch & Mission Support	264	341
Propulsion Systems	582	727
Space Shuttle Operations—Total	2,305	2,563
Flight Operations	686	773
Flight Hardware	1,113	1,237
Launch & Landing Operations	507	554
Expendable Launch Vehicles	86	170
Space and Ground Networks, Communications & Data Systems—Total	945	1,102

Source: "NASA Budget Briefing Background Material" (Annually).
Note: Detail may not add to totals because of rounding.
E Estimate. Latest year reflects Administration's budget proposal.

DEPARTMENT OF DEFENSE SPACE PROGRAMS[a] PROCUREMENT (INCLUDING INITIAL SPARES) AND RDT&E

Fiscal Years 1988, 1989 and 1990
(Millions of Dollars)

Agency and Program	1988		1989		1990	
	Procurement	RDT&E	Procurement	RDT&E	Procurement	RDT&E
AIR FORCE						
Advanced Launch System	$ —	$ —	$ —	$ —	$ —	$ —
Defense Meteorological Satellite Program (DMSP)	68.7	41.8	157.8	52.2	137.4	52.6
Defense Satellite Communications System (DSCS)	69.0	43.3	53.9	33.7	49.1	28.1
Medium Launch Vehicle	198.3	—	256.2	—	199.4	—
Navstar Global Positioning System	91.4	26.2	74.6	47.5	70.3	33.3
Space Boosters	499.8	451.7	341.5	473.2	247.5	405.9
Space Shuttle Operations	93.5	48.7	6.6	39.6	46.1	64.7
NAVY						
Fleet Satellite Communications (Fltsatcom)	$174.6	$ 21.5	$173.6	$ 20.0	$312.8	$ 15.9
JOINT PROGRAMS						
Strategic Defense Initiative	$ —	$ —	$ —	$3,710	$ —	$5,603

Source: "Program Acquisition Costs by Weapon System," "Procurement Program (P-1)," and "RDT&E Programs (R-1)," Department of Defense Budget (Annually).
[a] Total Obligational Authority.
E Estimate. Latest year reflects Administration's budget proposal.
NA Not available.

STRATEGIC DEFENSE INITIATIVE ORGANIZATION BUDGET PROGRAM

Fiscal Years 1987-1990
(Millions of Dollars)

Program	1987	1988	1989^E	1990^E
TOTAL	$3,279.7	$3,553.0	$3,627.4	$5,590.5
Surveill, Acquisit, Tracking & Kill Assess—TOTAL	923.0	934.5	1,100.7	1,281.0
Radar Discrimination Technology & Data Base	12.1	16.3	21.2	29.0
Optical Discrimination Technology & Data Base	93.5	99.1	110.6	123.8
Microwave Radar Technology	24.5	17.3	14.3	29.0
Laser Radar Technology	87.2	79.9	80.8	98.9
Passive Sensor Technology	71.7	55.8	71.3	95.9
Booster Surveill & Tracking System Dem/Val	127.1	174.0	235.0	67.5
Midcourse Dem/Val	39.6	37.7	106.0	163.8
Midcourse Experiment	109.8	99.7	93.6	42.9
Terminal Dem/Val	24.7	36.9	72.4	144.5
SATKA Support	118.2	117.2	122.6	217.5
Signal Processing Technology	91.6	68.1	81.9	100.8
Interactive Disc Tech	15.6	23.1	14.0	37.9
IS&T	—	58.4	43.3	96.6
Delta Star	—	7.5	—	—
Shuttle Recovery	13.6	—	—	—
Support Programs	93.6	43.5	31.9	33.0
Directed Energy Weapons Technology—TOTAL	853.1	934.3	819.8	1,116.9
CL Technology	87.0	100.1	100.1	346.5
FEL Technology	184.3	172.1	202.3	275.1
NPB Technology	144.7	109.0	96.6	114.8
ATP Technology	239.7	252.3	183.7	254.6
MIRACL/T	36.7	27.5	4.0	—
IS&T	—	19.3	15.0	34.1
Support Programs	63.3	21.6	46.9	27.1
CDTV/Emerging Tech	97.5	167.1	96.2	64.7
Delta Star	—	65.2	73.0	—
Kinetic Energy Weapons Technology—TOTAL	722.5	773.2	773.1	1,346.5
Endoatmospheric Interceptor Dev	100.1	106.3	145.9	218.6
Exoatmospheric Interceptor Dev	104.5	116.0	202.3	244.2
Space Systems	118.8	165.0	132.0	346.3
Advanced Tech Weapons	72.9	117.6	89.1	217.7
Test & Evaluation	239.1	133.1	68.0	107.1
Technology Support	43.9	5.7	9.4	9.5
Theater Defense	—	68.0	75.8	139.3
IS&T	—	23.4	21.7	41.3
Delta Star	—	6.1	—	—
Support Programs	43.3	32.1	29.0	22.5

(Continued on Next Page)

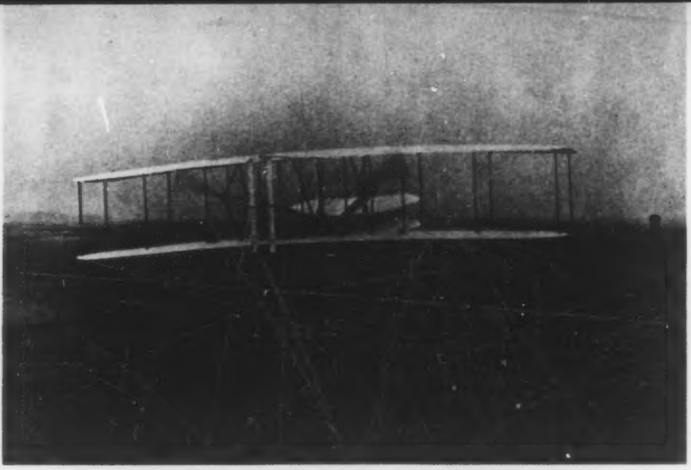
STRATEGIC DEFENSE INITIATIVE ORGANIZATION BUDGET PROGRAM (Continued)

Program	1987	1988	1989[E]	1990[E]
Systems Analysis and Battle Management—TOTAL	385.8	461.5	506.5	780.9
SDS Phase I Engineering	—	45.2	63.5	125.2
SDS Engineering and Support	88.9	72.6	82.1	131.4
Theater Defense	33.4	50.5	30.6	48.9
BM/C^3 Experimental Technology	83.2	64.3	58.6	86.4
BM/C^3 Experimental Systems	68.0	91.1	74.2	143.8
National Test Bed	46.5	77.7	100.2	115.8
Test & Evaluation	—	5.9	8.5	10.0
IS&T	—	12.9	15.4	25.8
Technology Applications	—	18.5	20.3	23.0
Support Programs	65.8	22.9	53.3	70.6
Survivability, Lethality & Key Technologies—TOTAL	375.3	429.6	406.3	776.8
System Survivability	58.7	91.3	103.0	169.5
Lethality & Target Hardening	76.4	68.6	62.2	124.4
Power & Power Conditioning	83.9	97.2	99.5	205.3
Space Transportation & Support	82.6	79.6	55.0	124.8
Materials and Structures	13.8	24.9	30.7	68.4
Countermeasures	—	21.2	22.3	35.0
IS&T	—	23.6	18.4	40.9
Support Programs	59.9	23.1	15.2	8.5
Management Headquarters—TOTAL	20.0	20.0	21.0	26.4
Strategic Defense System Phase One—TOTAL	—	—	—	262.0

Source: U.S. Government, "Report to the Congress on the Strategic Defense Initiative, 1987," and Department of Defense, "RDT&E Programs (R-1)."

NOTE: Detail may not add to totals because of rounding.

[E] Estimate. Latest two years represent Administration's budget proposal.



Air Transportation

In 1988, as in the previous year, the U.S. airline industry recorded record levels of traffic, revenues and operating profit.

U.S. carriers had operating revenues of $63.6 billion in combined domestic/international operations; the figure compares with $56.8 billion in 1987. The operating profit amounted to $3.5 billion, up from $2.4 billion in the previous year.

Domestic operations in 1988 accounted for roughly 80 percent of total revenues and 70 percent of the profit. Domestic revenues of $50 billion produced an operating profit of $2.5 billion; the comparable figures for the previous year were $45.7 billion and $1.7 billion.

In international service, revenues again climbed sharply, as they had in 1987. Operating revenues in 1988 were $13.3 billion, up from the previous all-time record of $10.9 billion in 1987. The operating profit similarly showed a sharp rise, to $971 million from 1987's $698 million.

The upward trend in traffic aboard U.S.

scheduled airlines, in evidence since 1982, continued in 1988 with a 6.6 percent gain in revenue ton miles to 53.8 billion from 1987's 50.5 billion. The breakdown: 42.3 billion revenue passenger ton miles and 11.5 cargo ton miles, both records. The total revenue load factor increased to 55 percent from 54.7 percent in the previous year.

In domestic service, U.S. scheduled carriers boarded more than 419 million passengers, up slightly from 417 million in 1987. The airlines flew 329.3 million domestic revenue passenger miles, which compares with 324.6 million in the previous year. The domestic service load factor was 61.4 percent, down from 61.6 percent.

International traffic carried by U.S. scheduled airlines continued its impressive growth with a gain of 15 percent in passengers boarded. Enplanements totaled 35.4 million, an all-time high. Revenue passenger miles amounted to 94 billion, an 18 percent gain over 1987. The international service load factor was 67.1 percent, up from 65.6 percent.

The U.S. air carrier fleet continued to grow with the addition of 407 aircraft. The number of multi-engine aircraft in service at yearend 1988 was 5,660, which included 3,915 turbojets, 1,375 turboprops, 362 piston engine transports and 18 helicopters.

The global airline service picture also showed gains in operating revenues, profit and traffic. In scheduled operations by airlines of the International Civil Aviation Organization, operating revenues climbed more than 13 percent to $166 billion, up from the previous year's $147 billion. The operating result (gross profit) was $9.5 billion, which compares with $7.2 billion in 1987.

The world fleet of turbine engine aircraft in airline service increased by 864 units, according to Exxon International Company's annual survey, which excludes air taxi operations and the Soviet Union's national airline *Aeroflot*. Exxon reported a total of 12,575 active transports as of March 31, 1988; that compared with 11,711 in the previous year. The 1988 figure breaks down this way: turbojets, 8,085 (up from 7,600); turboprops, 4,219 (up from 3,808); turbine-powered helicopters 271 (down from 303).

Exxon's analysis of the origin of the airplanes in the world fleet shows that, despite intense competition from foreign manufacturers, transports of U.S. manufacturers still account for almost two thirds of the total turbine-powered airline transports. As of March 31, 1988, U.S.-built aircraft numbered 8,193, or 65.2 percent of the total; the comparable figures for the prior year are 65.7 percent, 7,699 aircraft. Among turbojet aircraft, the percentage was 82.8 percent, down from 83.1 percent in 1987. U.S. manufacturers, however, produced only 31.6 percent (up from 31.1 percent) of the turboprop aircraft in service. U.S. builders accounted for 62 percent of the operating turbine-powered helicopters, down from 66.7 percent in 1987.

OPERATING REVENUES AND EXPENSES OF WORLD SCHEDULED AIRLINES[a]

Calendar Years 1983-1988
(Millions of U.S. Dollars)

	1983	1984	1985	1986	1987	1988[p]
OPERATING REVENUES:						
Scheduled Services:						
Passenger	$77,600	$81,720	$87,000	$94,900	$111,820	
Freight	10,830	12,560	13,300	15,200	17,450	
Mail	1,470	1,500	1,700	1,800	1,970	
Total Scheduled Services	$89,900	$95,780	$102,000	$111,900	$131,240	N/A
Non-Scheduled Services	2,800	3,010	3,500	4,500	5,410	
Incidental	5,600	6,610	6,700	8,200	10,350	
Total Operating Revenues	$98,300	$105,400	$112,200	$124,600	$147,000	$166,000
OPERATING EXPENSES:						
Flight Operations	$33,050	$33,350	$34,930	$32,710	$36,790	
Maintenance & Overhaul	9,620	10,120	11,070	13,850	15,900	
Depreciation & Amortization	6,920	7,240	7,770	9,070	11,050	
User Charges & Station Expenses	15,260	16,080	17,340	21,340	24,770	N/A
Passenger Services	8,810	9,190	10,310	12,140	14,540	
Ticketing, Sales & Promotion	15,810	16,560	18,470	21,480	24,440	
General, Administrative & Other	6,730	7,760	8,210	9,410	12,310	
Total Operating Expenses	$96,200	$100,300	$108,100	$120,000	$139,800	$156,500
OPERATING RESULT	$2,100	$5,100	$4,100	$4,600	$7,200	$9,500
Percent of Revenue	2.1%	4.8%	3.7%	3.7%	4.9%	5.7%
NET RESULT[b]	$(700)	$2,000	2,100	1,500	2,500	N/A
Percent of Revenue	(0.7%)	1.9%	1.9%	1.2%	1.7%	N/A

Source: International Civil Aviation Organization.

NOTE: Data in parentheses represent negative values.

[a] Excludes domestic operations in the USSR.

[b] Net Result equals Operating Result minus non-operating items, including interest, income taxes, retirement of property and equipment, affiliated companies and subsidies.

NA Not available.

p Preliminary.

r Revised.

TRAFFIC STATISTICS
WORLD AIRLINE SCHEDULED SERVICE[a]

Calendar Years 1970-1988

						Ton-Miles Performed		
Year	Passengers Carried	Freight Tons Carried	Passenger-Miles Performed	Seat-Miles Available	Passenger Load Factor	Freight	Mail	TOTAL (Passengers & Baggage, Freight, Mail)
	(Millions)		(Billions)		(Percent)	(Millions)		
1970	383	6.7	286	522	55%	8,180	2,150	38,810
1971	411	7.4	307	568	54	9,060	1,990	41,420
1972	450	8.0	348	609	57	10,290	1,900	46,690
1973	489	9.0	384	667	58	12,010	1,970	51,910
1974	515	9.5	408	688	59	13,030	1,980	55,270
1975	534	9.6	433	733	59	13,270	1,990	58,080
1976	576	10.3	475	789	60	14,750	2,080	63,880
1977	610	11.1	508	837	61	16,190	2,180	68,790
1978	679	11.7	582	902	65	17,770	2,240	77,770
1979	754	12.1	659	999	66	19,190	2,350	86,900
1980	748	12.2	677	1,071	63	20,120	2,520	89,710
1981	752	12.0	695	1,091	64	21,150	2,600	92,800
1982	766	12.8	710	1,115	64	21,600	2,650	94,830
1983	798	13.5	739	1,151	64	24,050	2,740	100,270
1984[r]	847	14.7	794	1,225	65	27,150	2,950	108,970
1985[r]	898	15.1	849	1,292	66	27,270	3,010	114,750
1986[r]	958	16.2	901	1,387	65	29,570	3,100	122,360
1987[r]	1,025	17.6	986	1,469	67	33,070	3,200	134,350
1988[p]	1,072	19.2	1,054	1,557	68	36,710	3,280	144,620

Source: International Civil Aviation Organization (ICAO).

[a] Includes international and domestic traffic on scheduled service performed by the airlines of the 160 States which were members of ICAO in 1988.

[r] Revised.

[p] Preliminary.

OPERATING REVENUES AND EXPENSES OF U.S. AIR CARRIERS[a] DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1964-1988
(Millions of Dollars)

	TOTAL OPERATIONS[b]			Domestic Operations			International Operations		
Year	Operating Revenues	Operating Expenses	Operating Profit (or Loss)	Operating Revenues	Operating Expenses	Operating Profit (or Loss)	Operating Revenues	Operating Expenses	Operating Profit (or Loss)
1964	$ 4,251	$ 3,781	$ 470	$ 3,169	$ 2,849	$ 320	$1,082	$ 932	$150
1965	4,958	4,286	672	3,691	3,239	452	1,267	1,047	220
1966	5,745	4,970	775	4,171	3,670	502	1,574	1,300	274
1967	6,865	6,157	708	4,981	4,560	421	1,884	1,597	287
1968	7,753	7,248	505	5,691	5,397	295	2,062	1,852	210
1969	8,791	8,403	387	6,936	6,613	322	1,855	1,790	65
1970	9,290	9,247	43	7,180	7,181	(1)	2,109	2,066	44
1971	10,046	9,717	328	7,753	7,496	257	2,292	2,221	71
1972	11,163	10,578	584	8,652	8,158	493	2,512	2,420	91
1973	12,419	11,834	585	9,694	9,200	494	2,725	2,633	91
1974	14,703	13,978	725	11,546	10,761	785	3,157	3,218	(60)
1975	15,356	15,229	128	12,020	11,902	117	3,336	3,326	11
1976	17,503	16,781	721	13,899	13,324	575	3,605	3,457	147
1977	19,926	19,018	908	15,822	15,166	657	4,104	3,852	252
1978	22,892	21,527	1,366	18,189	17,172	1,018	4,703	4,355	348
1979	27,227	27,028	199	21,652	21,523	129	5,575	5,505	69
1980	33,728	33,949	(222)	26,404	26,409	(6)	6,543	6,766	(223)
1981	36,211	36,612	(401)	28,788	29,051	(264)	6,390	6,574	(184)
1982	36,066	36,804	(739)	28,728	29,478	(750)	6,435	6,452	(17)
1983	38,593	38,231	362	31,014	31,186	(171)	7,163	6,693	470
1984	44,060	41,946	2,114	35,394	33,812	1,582	7,975	7,485	490
1985	48,580	47,207	1,372	37,628	36,610	1,018	8,302	7,984	319
1986	50,086	48,855	1,231	41,043	39,983	1,060	8,626	8,461	165
1987[r]	56,787	54,339	2,448	45,658	43,925	1,733	10,925	10,226	698
1988	63,633	60,136	3,497	50,052	47,562	2,489	13,332	12,361	971

Source: U.S. Department of Transportation Office of Aviation Information Management, Financial Data Branch.

NOTE: Detail may not add to totals because of rounding.

[a] Scheduled and non-scheduled service for all certificated route air carriers. Excludes supplemental air carriers, commuters, and air taxis.

[b] For 1980 and subsequent years, includes 'Other' operations not reported as 'Domestic' or 'International.'

[r] Revised.

SOURCES OF OPERATING REVENUES OF U.S. AIR CARRIERS[a] DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1974-1988
(Millions of Dollars)

Year	TOTAL Operating Revenues	Passenger Service[b]	Mail[c]	Freight[b] & Air Express	Excess Baggage	Other[c]
DOMESTIC OPERATIONS						
1974	$11,546	$ 9,903	$264	$ 772	$17	$ 589
1975	12,020	10,301	253	792	19	655
1976	13,899	12,104	294	942	22	537
1977	15,822	13,773	355	1,109	21	564
1978	18,189	15,753	336	1,347	23	730
1979	21,652	18,931	417	1,485	28	791
1980	26,404	23,317	446	1,582	32	1,027
1981	28,788	25,504	497	1,659	36	1,091
1982	28,728	25,440	524	1,505	42	1,218
1983	31,014	27,519	516	1,602	52	1,326
1984[r]	35,393	31,437	552	1,716	70	1,618
1985[r]	37,628	33,340	733	1,582	78	1,895
1986[r]	41,043	33,842	679	4,278	85	2,159
1987[r]	45,658	37,492	704	4,952	67	2,443
1988	50,052	41,021	693	5,754	72	2,512
INTERNATIONAL OPERATIONS						
1974	$ 3,157	$ 2,353	$118	$ 542	$21	$ 122
1975	3,336	2,469	122	591	25	129
1976	3,605	2,665	112	626	27	175
1977	4,104	3,047	112	710	21	215
1978	4,703	3,534	117	750	20	282
1979	5,575	4,271	131	837	23	313
1980	6,543	4,984	175	1,011	25	348
1981	6,390	4,917	165	984	25	299
1982	6,435	4,959	177	990	25	284
1983	7,163	5,605	152	999	23	384
1984	7,975	6,074	158	1,169	27	547
1985[r]	8,302	6,454	160	1,131	28	529
1986[r]	8,626	6,553	154	1,451	28	440
1987[r]	10,925	8,374	180	1,783	33	555
1988	13,332	10,331	184	2,106	39	672

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.

NOTE: Detail may not add to totals because of rounding.

[a] Scheduled and non-scheduled service for all certificated route air carriers. Excludes supplemental air carriers, commuters, and air taxis.

[b] Scheduled and charter.

[c] Subsidy included with Mail through 1979, and then included in Other, which also includes revenues not related to transport, plus, beginning in 1981, transport revenues not specifically broken out by category by some small carriers.

[r] Revised.

OPERATING EXPENSES OF U.S. AIR CARRIERS[a] DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1974-1988
(Millions of Dollars)

Year	TOTAL Operating Expenses	Flying Operations	Maintenance	Passenger Service	Aircraft & Traffic Servicing	Promotion and Sales	Depreciation & Amortization	Other[b]
DOMESTIC OPERATIONS								
1974	$10,761	$ 3,345	$1,514	$1,027	$2,026	$1,178	$ 871	$ 799
1975	11,902	3,919	1,611	1,117	2,158	1,271	891	936
1976	13,324	4,448	1,816	1,260	2,443	1,495	927	935
1977	15,166	5,288	2,001	1,461	2,728	1,713	967	1,008
1978	17,172	5,669	2,155	1,711	3,120	2,040	1,231	1,246
1979	21,523	7,998	2,457	2,091	3,702	2,564	1,373	1,337
1980	26,409	11,029	2,758	2,329	4,051	3,096	1,586	1,560
1981	29,051	12,037	2,822	2,522	4,497	3,708	1,723	1,742
1982	29,478	11,529	2,709	2,668	4,665	4,160	1,876	1,869
1983	31,186	11,370	2,878	2,983	5,104	4,764	2,107	1,980
1984	33,812	12,161	3,176	3,192	5,369	5,310	2,223	2,380
1985	36,610	12,684	3,604	3,464	5,781	6,089	2,318	2,670
1986	39,983	11,379	4,484	3,793	7,680	6,820	2,656	3,171
1987[r]	43,925	12,509	4,951	4,169	8,575	7,399	2,855	3,468
1988	47,562	13,100	5,620	4,453	9,545	8,204	2,974	3,667
INTERNATIONAL OPERATIONS								
1974	$ 3,218	$ 1,136	$ 381	$ 295	$ 538	$ 386	$ 230	$ 252
1975	3,326	1,175	392	292	565	422	225	254
1976	3,457	1,215	399	300	597	473	205	268
1977	3,852	1,303	450	351	668	526	253	301
1978	4,355	1,351	498	427	768	623	323	363
1979	5,505	1,960	571	538	922	774	352	388
1980	6,766	2,775	616	600	1,049	917	385	423
1981	6,574	2,757	540	583	932	945	382	435
1982	6,452	2,596	512	577	893	954	396	525
1983	6,693	2,490	548	664	936	1,162	389	505
1984	7,485	2,629	677	749	975	1,308	446	701
1985	7,984	2,738	768	852	1,069	1,414	482	662
1986	8,461	2,403	901	877	1,386	1,665	518	711
1987[r]	10,226	2,836	1,096	1,059	1,749	2,094	533	860
1988	12,361	3,230	1,308	1,282	2,180	2,749	616	997

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
NOTE: Detail may not add to totals because of rounding.

[a] Scheduled and non-scheduled service for all certificated route air carriers. Excludes supplemental air carriers, commuters, and air taxis.

[b] General and administrative, and other transport-related expenses.

[r] Revised.

U.S. AIR CARRIERS
TOTAL ASSETS AND INVESTMENT IN EQUIPMENT

Calendar Years 1969-1988
(Millions of Dollars)

Year	TOTAL Assets	Value of Flight Equipment	Value of Ground Property & Equipment, & Other[a]	Less: Reserves for Depreciation & Overhaul	Equals: Net Value of Owned Operating Property & Equipment	Investment in Operating Property and Equipment as a Percent of Total Assets
1969	$12,069	$ 9,943	$1,516	$ 3,560	$ 7,899	65.4%
1970	12,913	10,950	1,951	4,120	8,782	68.0
1971	12,998	11,221	2,028	4,649	8,600	66.2
1972	13,635	11,918	2,225	5,115	9,028	66.2
1973	14,464	12,908	2,424	5,693	9,639	66.6
1974	15,200	13,538	2,539	6,252	9,826	64.6
1975	15,064	14,035	2,635	6,823	9,847	65.4
1976	15,454	14,399	2,792	7,585	9,605	62.2
1977	16,869	14,822	2,997	8,141	9,679	57.4
1978	20,745	16,127	3,367	8,799	10,696	51.6
1979	24,907	18,561	3,985	9,746	12,800	51.4
1980	28,900	20,859	4,682	10,309	15,233	52.7
1981	30,513	22,375	5,175	11,028	16,521	54.1
1982	31,525	23,786	5,424	11,405	17,804	56.5
1983	35,213	26,588	6,191	12,910	19,868	56.4
1984	36,769	28,509	6,061	14,043	20,527	55.8
1985	40,978	30,402	6,772	15,467	21,707	53.0
1986	47,105	31,750	8,468	14,764	25,454	54.0
1987[r]	51,436	33,177	9,223	15,580	26,820	52.1
1988	56,046	35,780	10,248	17,453	28,576	51.0

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.

[a] Includes land and construction in progress.

[r] Revised.

TRAFFIC STATISTICS
U.S. AIR CARRIER SCHEDULED SERVICE[a]

Calendar Years 1964-1988

Year	Revenue Ton Miles (Millions)			Total Available Ton Miles (Millions)	Total Revenue Load Factor	Aircraft Revenue Miles (Millions)	Average Over-All Flight Stage Length (Miles)	Average Available Seats per Aircraft Mile
	Passenger	Cargo[b]	Total					
1964	5,630	1,803	7,434	15,514	47.9%	1,189	301	93
1965	6,629	2,356	8,986	18,408	48.8	1,354	322	96
1966	7,736	2,949	10,686	20,939	51.0	1,482	339	98
1967	9,561	3,475	13,036	26,968	48.3	1,834	371	101
1968	11,023	4,226	15,249	33,221	45.9	2,146	401	107
1969	12,197	4,701	16,898	38,664	43.7	2,385	443	112
1970	13,171	4,994	18,166	41,693	43.6	2,426	473	117
1971	13,565	5,120	18,685	44,139	42.3	2,378	476	125
1972	15,241	5,506	20,746	45,583	45.5	2,376	471	129
1973	16,196	6,046	22,242	49,019	45.4	2,448	477	135
1974	16,292	6,133	22,425	46,848	47.9	2,258	478	140
1975	16,281	5,905	22,186	47,254	46.9	2,241	476	143
1976	17,899	6,222	24,121	49,325	48.9	2,320	480	146
1977	19,322	6,587	25,909	52,284	49.6	2,419	490	149
1978	22,678	7,001	29,679	54,765	54.2	2,520	502	152
1979	26,202	7,189	33,390	60,844	54.9	2,791	517	154
1980	25,519	7,084	32,603	62,983	51.8	2,816	526	158
1981	24,889	7,060	31,949	61,186	52.2	2,703	519	161
1982	25,964	6,886	32,850	62,401	52.6	2,699	544	167
1983	28,183	7,573	35,756	65,385	54.7	2,809	558	169
1984	30,512	8,185	38,697	72,223	53.6	3,134	575	168
1985	33,640	7,689	41,329	76,059	54.3	3,320	569	168
1986	36,655	9,026	45,681	85,140	53.7	3,725	580	168
1987[r]	40,453	10,016	50,469	92,209	54.7	3,988	606	167
1988	42,330	11,469	53,780	97,899	55.0	4,141	618	169

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
NOTE: Detail may not add to totals because of rounding.
[a] Includes international and domestic operations.
[b] Includes freight, air express, U.S. and foreign mail.
[r] Revised.

PASSENGER STATISTICS U.S. AIR CARRIER SCHEDULED SERVICE DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1974-1988

Year	Revenue Passenger Enplanements (Thousands)	Average Passenger Trip-Length (Miles)	Revenue Passenger Miles (Millions)	Available Seat Miles (Millions)	Revenue Passenger Load Factor[a]
DOMESTIC OPERATIONS					
1974	189,733	684	129,732	233,880	55.5%
1975	188,746	698	131,728	241,282	54.6
1976	206,279	704	145,271	261,248	55.6
1977	222,283	705	156,609	280,619	55.8
1978	253,957	719	182,669	299,542	61.0
1979	292,700	714	208,891	332,796	62.8
1980	272,829	736	200,829	346,028	58.0
1981	265,304	749	198,715	346,172	57.4
1982	274,342	766	210,149	359,528	58.5
1983	296,721	765	226,909	379,150	59.8
1984	321,047	759	243,692	422,507	57.7
1985	357,109	758	270,584	445,826	60.7
1986	393,864	767	302,090	497,991	60.7
1987[r]	416,831	779	324,637	526,958	61.6
1988	419,210	786	329,309	536,663	61.4
INTERNATIONAL OPERATIONS					
1974	17,725	1,872	33,186	63,126	52.6%
1975	16,316	1,905	31,082	61,724	50.4
1976	17,039	1,979	33,717	61,574	54.8
1977	18,043	2,029	36,610	64,947	56.4
1978	20,759	2,125	44,112	69,209	63.7
1979	24,163	2,199	53,132	83,330	63.8
1980	24,074	2,258	54,363	86,507	62.8
1981	20,672	2,427	50,173	78,725	63.7
1982	19,760	2,505	49,495	80,591	61.4
1983	21,917	2,506	54,920	85,388	64.3
1984	23,636	2,599	61,424	92,817	66.2
1985	24,913	2,642	65,819	101,963	64.6
1986	25,082	2,570	64,456	109,445	58.9
1987[r]	30,847	2,588	79,834	121,763	65.6
1988	35,404	2,655	93,992	140,140	67.1

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.

[a] Revenue passenger miles as a percent of available seat miles.

[r] Revised.

TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET

By Model Years 1984-1988

	1984	1985	1986	1987	1988
TOTAL AIRCRAFT IN SERVICE	10,248	10,496	10,999	11,711	12,575
Turbojets—TOTAL	6,802	6,900	7,188	7,600	8,085
Aerospatiale SE-210 Caravelle	100	89	67	60	59
Aerospatiale SN-601 Corvette	12	12	11	11	12
Airbus A300	220	237	247	267	272
Airbus A310	29	50	79	94	116
Airbus A320	—	—	—	—	2
B.Ae. 111	154	156	162	166	167
B.Ae. 146	10	21	37	59	82
B.Ae. HS-125	10	11	14	18	16
B.Ae./Aerospatiale Concorde	14	14	14	14	14
B.Ae. Trident	65	48	34	34	27
Boeing 707/720	365	322	284	273	245
Boeing 727	1,696	1,658	1,678	1,676	1,686
Boeing 737	940	1,008	1,135	1,284	1,426
Boeing 747	556	571	597	629	653
Boeing 757	33	56	89	117	167
Boeing 767	79	106	133	163	207
Canadair CL-601 Challenger	—	—	—	—	—
Cessna 500/550/650 Citation I/II	26	36	29	28	37
Convair 880/990	14	11	10	12	2
Dassault Falcon 10/20/50	43	28	32	30	39
Dassault Mercure	10	11	11	11	11
Fokker F-28 Fellowship	151	171	189	197	203
Fokker 100	—	—	—	—	1
Gates Learjet	27	32	30	43	56
Gulfstream II/III G-1159	15	15	13	15	14
Ilyushin IL-62	48	52	56	60	66
Ilyushin IL-76	37	36	42	44	55
Israel Aircraft 1121/1124	9	4	8	9	7
Lockheed L-1011 TriStar	231	222	217	230	229
Lockheed L-1329 JetStar	8	8	7	12	13
MBB Hansa HFB-320	1	—	1	1	1
McDonnell Douglas DC8	337	302	244	258	282
McDonnell Douglas DC-9/MD-80	1,021	1,066	1,149	1,218	1,315
McDonnell Douglas DC-10	346	357	356	355	361
Mitsubishi MU-300 Diamond	—	—	—	—	1
Rockwell/Sabreliner 60	—	—	1	—	—
Tupolev Tu-134	95	95	98	98	101
Tupolev Tu-154	47	45	57	74	87
Yakolev Yak-40/42	52	50	58	42	52
Turboprops—TOTAL	3,191	3,350	3,546	3,808	4,219
Aero Space Lines SuperGuppy	—	—	—	—	1
Aerospatiale N.262 Mohawk298	35	31	28	28	25
Aerospatiale/Aeritalia ATR 42	—	—	10	36	76
Airtech CN 235	—	—	—	—	2
Antonov An.12	11	9	11	14	14
Antonov An.24/26/30	152	143	163	200	215
B.Ae. (HP-137) Jetstream 31	33	49	88	114	166

(Continued on next page)

TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET
(Continued)
By Model 1984-1988

	1983	1984	1985	1986	1987
Turboprops (continued)					
B.Ae. Argosy	—	—	—	—	5
B.Ae. Vanguard	10	10	7	8	9
B.Ae. Viscount	94	87	68	47	45
B.Ae. HS-748	151	156	155	157	154
Beech 18 Turbo	6	12	8	15	21
Beech 99 163	174	179	169	171	
Beech 90 King Air	29	36	39	36	44
Beech 100 King Air	8	9	13	21	24
Beech 200 King Air	43	42	53	62	70
Beech 1900 5	35	42	64	73	
Bristol 175 Britannia	7	8	8	8	7
Canadair CL-44	17	17	16	15	14
CASA/Nurtanio C-212 Aviocar	91	106	105	97	103
Cessna 208 Caravan I	—	3	64	74	150
Cessna 425/441 Conquest I/II	16	17	16	16	9
Convair 580/600/640	141	149	146	142	131
DHC-2 Turbo Beaver	11	11	9	3	3
DHC-5 Buffalo	2	2	2	2	2
DHC-6 Twin Otter	488	468	455	450	464
DHC-7 Dash 7	85	89	90	95	100
DHC-8 Dash 8	—	2	21	55	82
Dornier DO 128 Turbo-Skyservant	1	1	—	—	—
Dornier DO-228	18	31	39	59	79
Douglas DC-3T Turbo Express	1	1	1	1	1
Embraer EMB-110 Bandeirante	232	217	207	232	231
Embraer EMB-120 Brasilia	—	—	8	28	64
Fokker/Fairchild F-27/FH-227 Friendship	411	426	434	436	434
Fokker 50	—	—	—	—	13
GAF Nomad	25	23	23	23	16
Grumman G-73 Turbo Mallard	6	6	7	8	11
Grumman G-159 Gulfstream I	23	28	26	31	32
Handley Page Herald	27	22	15	21	15
Hawker-Siddeley Argosy	7	7	7	5	—
IAI Arava	—	—	—	—	3
Ilyushin IL-18	75	74	72	71	69
Israel Aircraft Arava 101B	1	—	—	—	—
Lockheed L-188 Electra	84	91	76	77	79
Lockheed L-100/L-382 Hercules	59	62	60	56	52
Mitsubishi MU-2B	17	10	10	12	11
NAMC YS-11	118	118	117	108	107
Pilatus PC-6 Turbo Porter	27	30	33	25	—
Pilatus Britten-Norman BN-2T Turbo Islander	5	5	5	5	3
Piper PA-31T/42 Cheyenne	12	16	21	18	28
Piper T-1040	4	7	11	8	9
Rockwell Turbo Commander	8	6	10	9	11
Saab SF-340A	—	16	39	67	105
Saunders ST-27	10	10	10	11	9

(Continued on next page)

TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET (Continued)

By Model 1984-1988

	1984	1985	1986	1987	1988
Turboprops (continued)					
Shorts SC-5 Belfast	5	5	5	5	5
Shorts SC-7 Skyliner/Skyvan	34	27	29	15	14
Shorts 330	81	81	76	71	76
Shorts 360	41	66	78	106	130
Swearingen Merlin	17	26	30	52	45
Swearingen Metro	234	263	291	302	356
Transall C-160	9	9	9	8	8
Xian (Antonov) Y-7	1	1	1	10	20
Turbine-Powered **Helicopters—TOTAL**	255	246	265	303	271
Aerospatiale SA-315 Lama	5	5	3	3	3
Aerospatiale SA-316 Alouette III	12	12	12	11	9
Aerospatiale SA-318 Alouette II	2	1	1	4	4
Aerospatiale SA-319 Alouette III	-				
Astazou	2	2	2	4	4
Aerospatiale (Nurtanio) SA-330 Puma	19	19	18	23	23
Aerospatiale AS-332 Super Puma	5	5	5	5	5
Aerospatiale AS-335	-	-	1	-	-
Aerospatiale AS-350 Ecureuil/AStar	5	5	5	5	6
Aerospatiale AS-355 Ecureuil 2/Twinstar	2	2	2	2	2
Aerospatiale SA-360 Dauphin	8	-	-	-	-
Aerospatiale SA-365 Dauphin II	8	8	9	9	9
Bell (Agusta/Fuji) 204	12	10	8	6	6
Bell 205	6	6	6	2	2
Bell 206 Jetranger/Longranger	32	46	52	53	52
Bell 212	14	14	27	27	29
Bell (Fuji) 214/214ST	7	7	6	5	1
Bell 222 UT	-	4	5	5	4
Bell 412	1	4	5	5	5
Boeing Vertol 234 Chinook	6	4	4	3	3
Hughes (Kawasaki) 500	22	15	13	10	1
MBB/Kawasaki BK 117	-	-	1	1	1
MBB/Nurtanio Bo.105	7	7	9	34	34
Sikorsky S-55T	3	3	3	5	5
Sikorsky S-58T	14	12	11	13	7
Sikorsky S-61	42	36	37	41	34
Sikorsky S-76	15	15	20	27	19
Westland 30	6	3	-	-	3

Source: Exxon International Company, "Air World Survey," compiled by Aviation Data Service, Inc. (Annually).

NOTE: The "Air World Survey" covers the world's airlines with the exception of Aeroflot, the USSR national airline, and covers aircraft in service as of March 31. Excludes air taxi operators.

U.S. TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET

Calendar Years 1984-1988

	1984	1985	1986	1987	1988
TOTAL AIRCRAFT IN SERVICE	10,248	10,496	10,999	11,711	12,575
Number Manufactured in U.S.	6,728	6,930	7,284	7,699	8,193
Percent Manufactured in U.S.	65.7%	66.0%	66.2%	65.7%	65.2%
Turbojet Aircraft in Service	6,802	6,900	7,188	7,600	8,085
Number Manufactured in U.S.	5,695	5,770	5,971	6,313	6,693
Percent Manufactured in U.S.	83.7%	83.6%	83.1%	83.1%	82.8%
Turboprop Aircraft in Service	3,191	3,350	3,546	3,808	4,219
Number Manufactured in U.S.	859	983	1,116	1,184	1,332
Percent Manufactured in U.S.	26.9%	29.3%	31.5%	31.1%	31.6%
Turbine-Powered Helicopters In Service	255	246	265	303	271
Number Manufactured in U.S.	174	177	197	202	168
Percent Manufactured in U.S.	68.2%	72.0%	74.3%	66.7%	62.0%

Source: Exxon International Company, "Air World Survey," compiled by Aviation Data Service, Inc. (Annually).
NOTE: The "Air World Survey" covers the world's airlines with the exception of Aeroflot, the USSR national airline, and includes aircraft in serv[illegible]s of March 31. Excludes air taxi operators.

JET FUEL COSTS AND CONSUMPTION BY U.S. AIR CARRIERS

Calendar Years 1974-1988

Year	Gallons Consumed (Millions)	Total Cost (Millions)	Cost Per Gallon (Cents)	Cost Index (1972 = 100)	Cost of Fuel as Percent of Cash Operating Expenses
1974	9,565.2	$ 2,333.5	24.4¢	209.2	17.3%
1975	9,495.3	2,777.3	29.2	250.8	18.9
1976	9,820.8	3,116.1	31.7	272.0	19.2
1977	10,282.0	3,729.8	36.3	311.0	20.1
1978	10,627.1	4,178.2	39.3	337.1	19.7
1979	11,278.1	6,503.0	57.7	494.4	24.4
1980	10,874.0	9,769.5	89.8	770.3	29.7
1981	10,087.8	10,498.0	104.1	892.2	29.3
1982	9,935.4	9,755.2	98.2	841.8	27.2
1983	10,207.8	9,073.1	88.9	762.0	24.5
1984	11,006.6	9,361.7	85.1	729.2	23.9
1985	11,595.1	9,326.7	80.4	689.6	22.8
1986[r]	12,542.8	6,939.7	55.3	474.3	16.3
1987[r]	13,394.0	7,485.9	55.9	479.2	16.0
1988	13,936.8	7,454.2	53.5	458.6	14.5

Source: Air Transport Association of America.
[a] Includes Majors and Nationals, per CAB classifications effective 1981, corresponding to previous categories of System Trunks and Local Service Carriers. Revised from previously reported data. Air Florida, Capitol and Transamerica not included in 1984 data, and excluded from prior year data for comparability.
[r] Revised.

U.S. CIVIL AND JOINT-USE AIRCRAFT FACILITIES[a] BY TYPE AND STATE

As of December 31, 1988

State	TOTAL[a]	Public[b]	Paved	Lighted	State	TOTAL[a]	Public[b]	Paved	Lighted
Alabama	201	104	133	98	Nevada	127	62	58	31
Alaska	603	429	60	142	New Hampshire	67	27	40	19
Arizona	272	76	153	68	New Jersey	317	59	132	60
Arkansas	195	97	128	87	New Mexico	167	72	78	54
California	907	275	646	250	New York	506	178	204	133
Colorado	396	85	165	99	N. Carolina	322	127	134	111
Connecticut	128	26	78	29	N. Dakota	486	103	76	99
Delaware	34	11	13	13	Ohio	714	202	272	194
Dist.of Col.	16	2	13	4	Oklahoma	399	162	205	133
Florida	669	132	282	154	Oregon	367	105	146	82
Georgia	352	118	179	117	Pennsylvania	756	168	286	149
Hawaii	54	14	42	13	Rhode Island	23	8	16	7
Idaho	209	117	76	43	S. Carolina	152	72	73	65
Illinois	924	126	249	166	S. Dakota	155	76	57	76
Indiana	545	119	154	123	Tennessee	208	91	123	86
Iowa	274	144	133	147	Texas	1,687	408	830	418
Kansas	390	148	131	140	Utah	113	50	72	43
Kentucky	148	74	94	61	Vermont	61	19	16	10
Louisiana	385	93	222	74	Virginia	313	77	141	88
Maine	146	78	47	32	Washington	413	137	191	134
Maryland	157	41	68	46	W. Virginia	93	40	56	32
Massachusetts	170	52	101	43	Wisconsin	457	150	168	136
Michigan	434	216	176	174	Wyoming	102	44	46	36
Minnesota	475	162	123	139	**50 States-Total**	17,259	5,640	7,386	4,865
Mississippi	205	91	110	83	Puerto Rico	28	11	23	11
Missouri	431	152	197	143	Virgin Islands	8	2	3	3
Montana	212	125	92	84	S. Pacific[c]	32	27	17	11
Nebraska	322	104	101	97	TOTAL	17,327	5,680	7,429	4,890

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation" (Annually).

[a] 17,327 aircraft facilities consists of 12,950 airports (5,352 for public use and 7,592 for private use), 3,913 heliports (114 for public and 3,799 for private use), 72 stolports (7 for public use and 65 for private use), and 392 seaplane bases (207 for public use and 185 for private use). Included in these data are facilities having joint civil-military use.

[b] "Public" refers to use, whether publicly or privately owned.

[c] American Samoa, Guam, and Trust Territories.

ACTIVE MULTI-ENGINE U.S. AIR CARRIER FLEET

By Type of Aircraft, Number of Engines and Model
Active as of December 1984-1988

	1984	1985	1986	1987	1988
TOTAL	4,370	4,678	4,909	5,253	5,660
Turbojets-TOTAL	2,959	3,164	3,283	3,575	3,915
Four-Engine-TOTAL	349	322	322	382	427
Boeing 707	22	27	35	31	31
Boeing 747	156	151	150	156	171
B.Ae.146	14	29	25	57	57
McDonnell Douglas DC-8	157	115	112	138	168
Three-Engine-TOTAL	1,438	1,488	1,466	1,469	1,542
Boeing 727	1,161	1,195	1,172	1,168	1,246
Lockheed L-1011	103	114	114	116	112
McDonnell Douglas DC-10	174	179	180	185	184
Twin-Engine-TOTAL	1,173	1,354	1,495	1,724	1,946
Airbus A-300	38	46	52	52	57
Airbus A-310	—	4	7	13	19
Boeing 737	391	476	555	633	706
Boeing 757	19	48	73	95	122
Boeing 767	53	59	69	83	126
B.Ae. BAC-111	33	32	45	39	30
Cessna C500 Citation I	1	2	—	—	—
Dassault MD-20, Falcon	11	2	—	—	—
Fokker F-28	23	41	50	47	47
Grumman G-1159	1	—	—	—	—
Israel Westwind 1123/1124	1	—	—	—	—
Learjet LR-25	—	—	—	—	1
Learjet LR-35	8	3	1	2	1
McDonnell Douglas DC-9/MD-80	594	641	643	760	837
Turboprops-TOTAL	956	1,076	1,204	1,241	1,375
Four-Engine-TOTAL	109	108	96	102	95
Canadair CL44D	5	6	2	6	6
De Havilland DHC-7	46	42	40	41	39
Lockheed 188 Electra	34	38	33	34	30
Lockheed 382/L-100 Hercules	22	22	21	21	20
Vickers V745	2	—	—	—	—

(Continued on next page)

ACTIVE MULTI-ENGINE U.S. AIR CARRIER FLEET
By Type of Aircraft, Number of Engines and Model (Continued)

	1984	1985	1986	1987	1988
Twin-Engine-TOTAL	847	968	1,108	1,139	1,280
Beech BE65	—	—	1	4	1
Beech BE90	2	3	1	4	1
Beech BE99	85	103	95	52	84
Beech BE200	6	1	2	5	7
Beech BE100	2	1	1	—	1
Beech STC 18	1	—	—	—	—
Beech BE1900	17	42	60	48	80
BAE Jetstream	10	46	69	113	135
CASA C212 Aviocar	27	24	19	16	18
Cessna C441	3	1	3	2	3
Convair 580/600/640	107	100	91	77	72
DeHavilland DHC6	107	86	68	71	63
DeHavilland DHC-8	—	10	26	34	44
Dornier DO228	—	6	12	18	33
Douglas DC-3	—	1	—	—	—
Embraer EMB110/EMB120	81	79	107	133	139
Fairchild/Fokker F-27/FH-227	46	63	63	47	18
Fairchild Swearingen SA-226	121	113	122	101	90
Fairchild Swearingen SA-227	70	101	135	163	191
Grumman G-73	—	3	—	—	7
Grumman G-159	21	23	15	14	5
Grumman 6500	—	—	—	—	1
Hawker-Siddeley HS748	2	—	—	—	—
Mitsubishi MU-2	1	3	6	1	—
Nihon YS-11	30	42	36	36	22
Nord ND-262/STC-262	14	14	15	12	9
Piper PA31T	8	4	5	6	9
Rockwell Aero Commander 690	4	4	4	1	1
Saab-Fairchild SF340A	3	17	34	51	68
Shorts SD-3/SD-330	78	77	110	110	110
Shorts SC-7	1	1	1	—	—
Societe Nationale Industrielle Aerospatiale SNAIS ATR-42	—	—	8	20	35
One-Engine-TOTAL	—	—	—	3	—
Cessna C208	—	—	—	3	—
Piston-Engine-TOTAL	443	433	420	421	362
Four-Engine-TOTAL	50	38	32	38	36
DeHavilland DHC-114	6	—	—	—	—
Douglas DC-4	3	3	1	—	—
Douglas DC-6	41	34	30	37	35
Douglas DC-7	—	1	1	1	1
Three-Engine-TOTAL	4	4	3	3	3
Pilatus Britten-Norman BN2A-MK-3 Trislander	4	4	3	3	3
Twin-Engine-TOTAL	389	391	385	380	323
Helicopters-TOTAL	12	5	2	13	8

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).

NOTE Effective 1978, includes certified route air carriers, supplemental air carriers (charters), and all aircraft over 12,500 pounds operated by air taxis, commercial operators and travel clubs. Effective 1978 includes multi-engine aircraft in passenger service of commuters. "Active aircraft" must have a current U.S. registration and have been flown during the calendar year.

Revised.

ACTIVE U.S. CIVIL AIRCRAFT[a]

As of December 31, 1963-1987

Year	TOTAL	Air Carrier[b]	General Aviation Aircraft					
			TOTAL	Fixed-Wing Aircraft			Rotorcraft[c]	Other[d]
				Multi-Engine	Single-Engine			
					4-place & over	3-place & less		
1963	87,167	2,079	85,088	9,695	42,647	30,977	1,171	588
1964	90,823	2,081	88,742	10,644	45,777	30,367	1,306	648
1965	97,567	2,125	95,442	11,977	49,789	31,364	1,503	809
1966	106,978	2,272	104,706	13,548	52,972	35,687	1,622	877
1967	116,638	2,452	114,186	14,651	56,865	39,675	1,899	1,096
1968	126,823	2,586	124,237	16,760	60,977	42,830	2,350	1,320
1969	133,496	2,690	130,806	18,111	63,703	45,001	2,557	1,434
1970	134,422	2,679	131,743	18,291	64,759	44,884	2,255	1,554
1971	133,790	2,642	131,148	17,855	64,464	44,792	2,352	1,685
1972	147,593	2,583	145,010	19,849	70,998	49,448	2,787	1,928
1973	156,139	2,599	153,540	21,929	74,831	51,386	3,143	2,251
1974	163,974	2,472	161,502	23,418	78,924	53,008	3,610	2,542
1975	170,970	2,495	168,475	24,559	82,621	54,390	4,073	2,832
1976	180,796	2,492	178,304	25,684	88,211	56,730	4,505	3,174
1977	186,767	2,473	184,294	26,652	91,960	57,340	4,726	3,616
1978	201,321	2,543	198,778	28,782	101,466	59,185	5,315	4,028
1979	213,948	3,609	210,339	31,311	106,028	62,362	5,864	4,770
1980	214,853	3,808	211,045	31,664	107,930	60,505	6,001	4,945
1981	217,196	3,970	213,226	33,301	107,983	59,914	6,974	5,049
1982	213,851	4,072	209,779	33,228	106,503	57,670	6,169	6,209
1983	217,496	4,203	213,293	34,404	107,228	59,199	6,540	5,923
1984	225,313	4,370	220,943	35,648	109,433	61,989	7,096	6,275
1985	215,332	4,678	210,654	33,588	105,555	58,829	6,418	6,263
1986	224,953	4,909	220,044	34,313	109,351	62,427	6,943	7,010
1987	222,436	5,253	217,183	33,032	107,502	63,533	6,333	6,783

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).

NOTE: Detail may not add to totals because of estimating procedures.

[a] Before 1971, an active aircraft was one certified as eligible to fly. Currently, an "active aircraft" must have a current U.S. registration and have been flown during the previous calendar year.

[b] Effective 1978, includes certificated route air carriers, supplemental air carriers (charters), and all aircraft over 12,500 pounds operated by air taxis, commercial operators and travel clubs. Effective 1979, includes multi-engine aircraft in commuter passenger service. Excludes single-engine aircraft as of 1978.

[c] Includes autogiros; excludes air carrier helicopters.

[d] Includes gliders, dirigibles and balloons.

ACTIVE U.S. CIVIL AIRCRAFT BY PRIMARY USE AND TYPE OF AIRCRAFT

As of December 31, 1987

Primary Use[a]	TOTAL	Fixed Wing			Rotorcraft[b]	Other[c]
		Turbojet	Turboprop	Piston		
TOTAL—ALL AIRCRAFT						
Air Carrier—TOTAL	5,253	3,575	1,244	421	13	—
Large	4,231	3,573	546	112	—	—
Small	1,022	2	698	309	13	—
General Aviation—TOTAL	217,183	4,338	5,274	194,455	6,333	6,783
Executive	11,960	3,123	3,253	4,740	740	104
Business	39,943	365	504	38,455	498	121
Commuter[d]	1,014	6	301	698	9	0
Air Taxi[d]	6,228	375	485	4,050	1,319	0
Instructional	15,727	26	57	14,749	314	582
Personal	123,487	39	144	117,712	835	4,758
Aerial Application	6,516	0	77	5,682	756	0
Aerial Observation	4,858	5	55	3,594	847	357
Other Work	1,577	1	14	1,109	221	232
Other	5,873	398	384	3,666	793	630

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation." (Annually)

NOTE: Detail may not add to totals because of estimating procedures.

[a] Definitions of "primary use" categories available in Glossary of "FAA Statistical Handbook."

[b] Includes helicopters and autogiros.

[c] Includes gliders, dirigibles and balloons.

[d] Air taxis under 12,500 pounds and single-engine commuters; other aircraft in these categories included with "air carriers."

U.S. GENERAL AVIATION
ACTIVE AIRCRAFT AND HOURS FLOWN
BY PRIMARY USE

Calendar Years 1983-1987

Primary Use[a]	1983	1984	1985	1986	1987
ACTIVE AIRCRAFT AS OF DECEMBER 31					
TOTAL	213,293	220,943	210,654	220,044	217,183
Executive	17,064	16,675	13,610	12,075	11,960
Business	45,025	47,098	45,544	43,780	39,943
Commuter	1,479	1,232	875	1,721	1,014
Air Taxi	6,857	7,292	6,459	7,568	6,228
Instructional	15,450	15,287	14,410	15,812	15,727
Rental[d]	7,674	9,406	7,919	—	—
Personal	101,484	105,309	103,053	120,308	123,487
Aerial Application[c]	7,051	7,332	7,286	7,068	6,516
Aerial Observation[c]	4,023	5,173	4,533	4,716	4,858
Other Work[c]	2,392	1,328	1,620	1,274	1,577
Other[c]	4,791	4,777	5,344	5,707	5,873
THOUSANDS OF HOURS FLOWN					
TOTAL	35,249	36,119	34,063	34,416	33,443
Executive	5,241	4,773	4,176	3,781	3,403
Business	5,956	6,635	6,534	5,896	5,713
Commuter[b]	1,602	1,504	674	2,185	1,359
Air Taxi[b]	2,528	3,019	2,719	2,913	2,877
Instructional	4,865	4,553	4,264	4,677	4,904
Rental[d]	2,389	2,855	2,646	—	—
Personal	8,477	8,418	8,392	10,097	10,787
Aerial Application[c]	1,762	2,008	2,168	1,985	1,666
Aerial Observation[c]	1,138	1,314	1,315	1,620	1,412
Other Work[c]	642	312	343	323	379
Other[c]	553	729	831	939	943

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).

NOTE: Detail may not add to totals because of rounding and estimating procedures.

[a] Definitions of "primary use" categories available in Glossary of "FAA Statistical Handbook."

[b] Air taxis under 12,500 pounds and single-engine commuters; other aircraft in these categories classified as "air carriers."

[c] Prior to 1981, reported as Aerial Application (differently defined), Industrial, and Other.

[d] Rental is not reported as a separate use category after 1985.

U.S. GENERAL AVIATION
TYPE OF AIRCRAFT AND HOURS FLOWN

Calendar Years 1983-1987

	1983	1984	1985	1986	1987
Number of Active Aircraft by Type					
All Aircraft—TOTAL	213,293	220,943	210,654	220,044	217,183
Fixed Wing: Piston:					
Single Engine:1-3 Seats	59,199	61,989	58,829	62,427	63,533
4 • Seats	107,228	109,933	105,555	109,351	107,502
Twin Engine: 1-6 Seats	16,249	16,539	15,627	16,166	15,741
7 • Seats	8,660	8,719	8,032	7,555	7,566
Other	143	262	148	148	112
Turboprop:					
Twin Engine: 1-12 Seats	4,733	4,992	4,633	4,809	4,337
13 • Seats	578	640	607	970	723
Other	142	176	167	185	214
Turboject: Twin Engine	3,447	3,780	3,914	4,037	3,900
Other	451	540	460	444	438
Rotorcraft: Piston	2,541	2,936	2,877	2,921	2,813
Turbine	3,998	4,160	3,541	4,022	3,520
Balloons, Dirigibles, and Gliders	5,923	6,275	6,263	7,010	6,783
Thousands of Hours Flown by Type of Aircraft					
All Aircraft—TOTAL	35,249	36,119	34,063	34,416	33,443
Fixed Wing: Piston	28,911	29,194	27,793	26,861	27,039
Turboprop	2,173	2,506	2,080	2,882	2,177
Turbojet	1,473	1,566	1,622	1,654	1,528
Rotorcraft: Piston	572	592	564	804	652
Turbine	1,700	1,903	1,590	1,821	1,631
Balloons, Dirigibles, and Gliders	420	358	414	394	416
Average Hours Flown per Year per Aircraft by Type					
All Aircraft—TOTAL	164	158	158	149	148
Fixed Wing: Piston:	134				
Single Engine: 1-3 Seats	140	139	135	125	126
4 + Seats	139	137	142	130	165
Twin-Engine: 1-6 Seats	187	181	174	172	289
7 + Seats	318	303	274	280	140
Other	240	433	184	111	
Turboprop:					
Twin Engine: 1-12 Seats	301	342	319	335	337
13 + Seats	1,139	1,112	831	1,013	652
Other	579	339	396	499	840
Turbojet: Twin Engine	392	349	375	385	372
Other	274	393	325	154	229
Rotorcraft: Piston	221	187	192	273	229
Turbine	432	469	460	459	485
Balloons, Dirigibles, and Gliders	71	56	67	56	62

Source: General Aviation Manufacturers Association, "General Aviation Statistical Databook," (Annually) based on data from the Federal Aviation Administration.

NOTE: Detail may not add to totals because of rounding and/or estimating procedures.

ACTIVE U.S. AIRMAN CERTIFICATES HELD

As of December 31, 1984-1988

	1984	1985	1986	1987	1988
Pilots-TOTAL	722,376	709,540	709,118	699,653	694,016
Students	150,081	146,652	150,273	146,016	136,913
Private	320,086	311,086	305,736	300,949	299,786
Commercial	155,929	151,632	147,798	143,645	143,030
Airline Transport	79,192	82,740	87,186	91,287	96,968
Helicopter (only)	7,532	8,123	8,581	8,702	8,608
Glider (only)[a]	8,390	8,168	8,411	7,901	7,600
Lighter-Than-Air[a]	1,166	1,139	1,133	1,153	1,111
Non-Pilots-TOTAL	426,802	395,139	410,079	427,962	443,710
Mechanics[b]	298,028	274,100	284,241	297,178	312,419
Parachute Rigger[b]	10,194	9,395	9,535	9,659	4,770
Ground Instructor[b]	67,463	58,214	59,443	60,861	62,582
Dispatcher[b]	8,980	8,511	9,025	9,491	10,020
Flight Navigator	1,603	1,542	1,512	1,445	1,400
Flight Engineer	40,534	43,377	46,323	49,328	52,519
Flight Instructor Certificates[c]	61,173	58,940	57,355	60,316	61,798
Instrument Ratings[c]	256,584	258,559	262,388	266,122	273,804

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).

[a] Glider and lighter-than-air pilots are not required to have a medical examination; however, the totals above are the pilots who received a medical.

[b] No periodic medical examination required; therefore, no determination as to current activity can be made.

[c] Special ratings shown on pilot certificates represented above, not additional certificates.

HELIPORTS/HELIPADS[a] IN THE UNITED STATES (Continued)

By State
As of 1988

State	Total Helipads in state	Private Use		Public Use	
		Heliports & Helistops	Helipads at Airports	Heliports & Helistops	Helipads at Airports
Alaska	33	14	3	8	8
Alabama	68	66	0	1	1
Arkansas	27	24	2	0	1
Arizona	102	100	0	0	2
California	376	349	2	1	24
Colorado	176	170	1	1	4
Connecticut	66	62	1	2	1
District of Columbia	21	19	0	0	2
Delaware	15	14	0	1	0
Florida	204	201	0	3	0
Georgia	81	80	0	0	1
Hawaii	21	17	0	1	3
Idaho	26	26	0	0	0
Illinois	220	210	3	6	1
Indiana	90	83	2	4	1
Iowa	50	49	0	0	1
Kansas	26	22	0	0	4
Kentucky	27	27	0	1	0
Louisiana	238	223	2	11	2
Maine	9	8	0	1	0
Maryland	48	46	2	0	0
Massachusetts	85	81	0	2	2
Michigan	62	60	1	1	0
Minnesota	25	22	1	0	2
Mississippi	23	23	0	0	0
Missouri	91	83	1	4	3
Montana	22	20	0	2	0
Nebraska	20	19	1	0	0
Nevada	28	28	0	1	0
New Hampshire	21	19	0	1	1
New Jersey	190	185	0	5	0
New Mexico	16	15	0	1	0

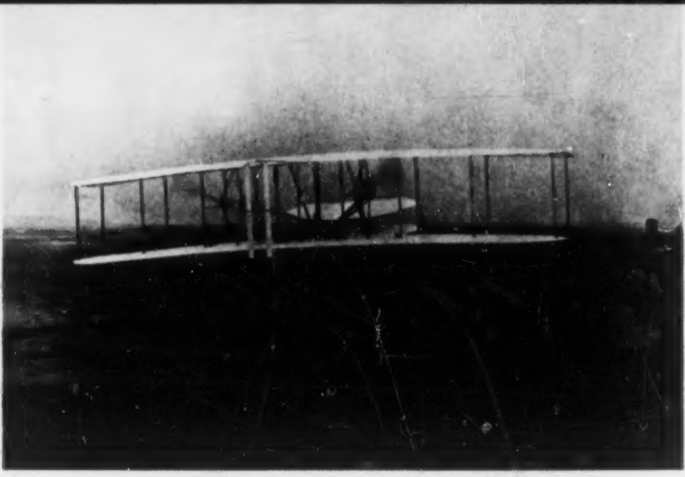
(Continued on next page)

HELIPORTS/HELIPADS[a] IN THE UNITED STATES (Continued)

By State
As of 1988

State	Total Helipads in state	Private Use		Public Use	
		Heliports & Helistops	Helipads at Airports	Heliports & Helistops	Helipads at Airports
New York	133	118	2	12	1
North Carolina	46	44	1	1	0
North Dakota	6	6	0	0	0
Ohio	203	176	2	20	5
Oklahoma	87	83	0	4	0
Oregon	80	76	2	2	0
Pennsylvania	259	246	1	12	0
Rhode Island	11	10	0	1	0
South Carolina	20	20	0	0	0
South Dakota	6	6	0	0	0
Tennessee	60	55	1	3	1
Texas	462	446	2	12	2
Utah	34	29	0	0	5
Virginia	94	89	0	2	3
Vermont	14	13	0	1	0
Washington	102	97	1	0	4
Wisconsin	28	28	0	0	0
West Virginia	25	25	0	0	0
Wyoming	13	12	0	0	1
Total U.S.	4,190	3,943	34	128	86

Source: Helicopter Association International, "1988 Helicopter Annual".
NOTE: 94.9 percent of all U.S. helicopter landing areas are private, while 5.1 percent are public.
[a] Excludes temporary heliports, offshore heliports or infrequently used helicopter landing sites.



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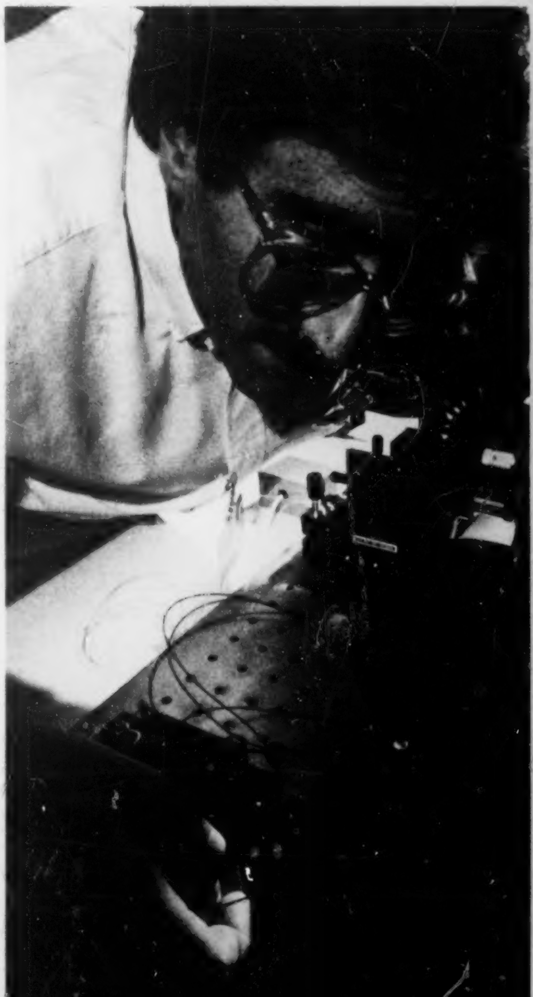
Research and Development



Traditionally the leader among industrial research and development performers, the aerospace industry will again head the list in 1989, according to a survey by Battelle Memorial Institute. However, total aerospace R&D funding will decline significantly.

Battelle estimated total expenditures for U.S. industrial R&D at $92.6 billion, down substantially from the previous year's total of $95.8 billion. The decline is due to sharply scaled back government funding for industry-performed R&D; government funding for 1989 is estimated at $30.8 billion, down from $34.7 billion in 1988. Industry funding will amount to $61.9 billion, up from $61.1 billion.

The aerospace industry will perform R&D valued at $19.2 billion, including $15.6 billion in federal funds and $3.5 billion in industry funds. It amounts to a decline of almost $5 billion in total funding, with reductions in both federal funding (down $3.5 billion) and industry funding (down $1.4 billion). The drop in federal support reflects lower defense budgets in Fiscal Years 1986-89; the lower industry figure is due principally to a decline in industry-financed Independent Research and Development occasioned by restrictive government-imposed ceilings on IR&D and the inability of manufacturers to recover an adequate percentage of defense-related IR&D costs.

The Battelle projection for 1989 put the electrical machinery and communications industrial group in second place behind aerospace with estimated total outlays of $18.5 billion. Next, in order, were machinery ($12.1 billion), chemicals ($11.5 billion) and transportation equipment ($11.4 billion).

The Department of Defense is by far the largest conductor of government-funded R&D, according to budget estimates. In FY 1989, federal outlays for DoD amounted to $37.3 billion, up from $35.4 billion in FY 1988. The National Aeronautics and Space Administration had outlays of $4.7 billion, up from $3.8 billion in 1987. Department of Energy outlays amounted to $5.3 billion, up from $5 billion. All other agencies combined spent $12.6 billion, up from $11.8 billion.

For FY 1990, total federal funding for R&D will increase from $59.9 billion to $64.4 billion. DoD will receive the greatest gross increase of $2.1 billion, while NASA will receive the greatest percentage increase of 30 percent or $1.4 billion. Projected R&D funding by department for FY 1990 is expected to be $39.4 billion to DoD, $6.2 billion to NASA, $5.5 billion to Energy, and $13.3 billion for all other Federal R&D.

Within the Department of Defense, the Air Force continues to lead the other services in terms of appropriations for Research, Development, Test and Evaluation (RDT&E). For FY 1989, the USAF appropriation is $14.7 billion, and for FY 1990 the projection indicates $14.8 billion; for the Navy, $9.3 billion in FY 1989 expected to rise in FY 1990 to $10.2 billion; and for the Army, $5.1 billion in FY 1989 with an increase to $5.6 billion projected for FY 1990.

A geographical breakdown of contractor-performed defense RDT&E showed that the Pacific region, perennial leader, once again topped the list of prime contract awards. The Pacific area won FY 1988 contracts—performed by industry, educational institutions and others—worth $8.3 billion or more than 37 percent of the total. The ranking and dollar value of contracts won by other regions was Mountain region ($2.8 billion, 12.7 percent); South Atlantic ($2.7 billion, 12.3 percent); New England ($2.6 billion, 11.8 percent); Middle Atlantic ($2.5 billion, 11.1 percent); West South Central ($1 billion, 4.7 percent); East North Central ($923 million, 4.2 percent); West North Central ($755 million, 3.4 percent); and East South Central ($516 million, 2.3 percent).

National Science Foundation data on industry expenditures for R&D showed that the aerospace industry continued in 1987 (latest information available) to exceed the mean for all U.S. manufacturing industries when R&D funding is measured as a percentage of sales. Aerospace funding for R&D (exclusive of government contractual work) amounted to 3.9 percent of net sales, compared with a 3.3 percent average for all U.S. manufacturing industries. The aerospace lead widened when company and government funding were combined; total aerospace R&D funding amounted to 15 percent of net sales compared with the all-industry average of 4.7 percent.

FUNDS FOR INDUSTRIAL RESEARCH AND DEVELOPMENT ALL INDUSTRIES AND THE AEROSPACE INDUSTRY

By Funding Source Calendar Years 1973-1987
(Millions of Dollars)

	All Industries[a]			Aerospace Industry[b]		
Year	Total	Federal Funds	Company Funds[c]	Total	Federal Funds	Company Funds[c]
CURRENT DOLLARS						
1973	$21,249	$ 8,145	$13,104	$ 5,052	$ 3,899	$1,154
1974	22,887	8,220	14,667	5,278	4,000	1,278
1975	24,187	8,605	15,582	5,713	4,428	1,285
1976	26,997	9,561	17,436	6,339	4,921	1,418
1977	29,825	10,485	19,340	7,033	5,486	1,547
1978	33,304	11,189	22,115	7,536	5,713	1,823
1979	38,226	12,518	25,708	8,041	5,840	2,201
1980	44,505	14,029	30,476	9,198	6,628	2,570
1981	51,810	16,382	35,428	11,968	8,528	3,440
1982[r]	59,010	18,534	40,476	14,272	10,098	4,174
1983[r]	65,694	20,657	45,037	15,089	11,103	3,986
1984[r]	76,087	23,356	52,731	18,206	13,478	4,728
1985[r]	85,610	27,130	58,480	21,229	15,628	5,601
1986[r]	88,896	27,171	61,725	20,180	14,230	5,949
1987	96,305	31,403	64,902	23,506	17,665	5,841
CONSTANT DOLLARS (1982 = 100)[d]						
1973	$42,893	$16,441	$26,452	$10,206	$ 7,877	$2,331
1974	42,415	15,234	27,181	9,774	7,407	2,367
1975	40,781	14,509	26,272	9,634	7,467	2,167
1976	42,805	15,159	27,646	10,046	7,799	2,247
1977	44,330	15,584	28,746	10,450	8,152	2,299
1978	46,115	15,493	30,622	10,438	7,913	2,525
1979	48,652	15,932	32,720	10,230	7,430	2,800
1980	51,919	16,366	35,553	10,733	7,734	2,999
1981	55,140	17,435	37,705	12,732	9,072	3,660
1982	59,010	18,534	40,476	14,272	10,098	4,174
1983	63,252	19,889	43,363	14,528	10,690	3,838
1984	70,627	21,680	48,947	16,900	12,511	4,389
1985[r]	77,161	24,452	52,708	19,134	14,086	5,048
1986	78,905	24,727	54,178	17,713	12,490	5,222
1987	81,843	26,687	55,156	19,976	15,012	4,964

Source: National Science Foundation.

NOTE: Detail may not add to totals because of rounding.

[a] Includes all manufacturing industries, plus those non-manufacturing industries known to conduct or finance research and development.

[b] Companies classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and parts.

[c] Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other non-profit organizations.

[d] Based on GNP implicit price deflator.

[r] Revised.

TOTAL U.S. FUNDS FOR RESEARCH AND DEVELOPMENT BY SOURCE AND PERFORMER[a]

Calendar Years 1986-1988
(Millions of Current Dollars)

Source of Funds	Performer					
	Total All Performers	Federal Government	Industry	Colleges & Universities	Federally-Funded Research & Development Centers	Nonprofit Institutions
1986[p]						
All Sources—TOTAL	$114,697	$13,535	$83,562	$10,600	$3,600	$3,400
Federal Government	55,273	13,535	28,988	6,750	3,600	2,400
Industry	55,549	—	54,574	600	—	375
Colleges & Universities	2,500	—	—	2,500	—	—
Nonprofit Institutions	1,375	—	—	750	—	625
1987[p]						
All Sources—TOTAL	$123,050	$15,450	$89,200	$11,150	$3,800	$2,400
Federal Government	60,350	15,450	31,700	7,000	3,800	2,400
Industry	58,570	—	57,500	670	—	400
Colleges & Universities	2,700	—	—	2,700	—	—
Nonprofit Institutions	1,430	—	—	780	—	650
1988[E]						
All Sources—TOTAL	$131,600	$16,400	$95,950	$11,725	$4,000	$3,525
Federal Government	64,550	16,400	34,500	7,250	4,000	2,400
Industry	62,625	—	61,450	750	—	425
Colleges & Universities	2,900	—	—	2,900	—	—
Nonprofit Institutions	1,525	—	—	825	—	700

Source: National Science Foundation.

[a] Source/performer detail not available by industry.

[p] Preliminary.

[E] Estimate.

ESTIMATED SOURCES OF FUNDS FOR R&D BY BROAD INDUSTRIAL CLASSES, 1989[a]

(Millions of Current Dollars)

	Federal Funds	Industry Funds	Total Funds	% Federal
Aerospace	$15,647	$3,511	$19,157	81.67%
Electrical Machinery and Communications	7,928	10,618	18,546	42.75
Machinery	1,669	10,457	12,126	13.76
Chemicals	381	11,134	11,515	3.31
Autos, Trucks & Parts, & Other Transportation Equipment	1,982	9,431	11,413	17.37
Professional & Scientific Instruments	991	5,531	6,522	15.19
Petroleum Products	21	2,068	2,089	1.00
Rubber Products	313	930	1,243	25.17
Food & Beverage	0	1,172	1,172	0.00
Paper/Pulp	0	1,009	1,009	0.00
Fabricated Metals	73	732	805	9.07
Stone, Clay & Glass	136	629	764	17.74
Nonferrous Metals	42	600	642	6.50
Iron & Steel	21	601	622	3.36
Textiles	0	176	176	0.00
Other Manufacturing	21	1,049	1,070	1.95
Total Manufacturing	$29,223	$59,648	$88,871	32.88
Nonmanufacturing	1,565	2,206	3,770	41.50
TOTAL	30,788	61,854	92,641	33.23

Source: Battelle Memorial Institute.

[a] Battelle data, derived from the National Science Foundation and McGraw-Hill surveys.

RESEARCH AND DEVELOPMENT FUNDS AS PERCENT OF NET SALES ALL MANUFACTURING INDUSTRIES AND THE AEROSPACE INDUSTRY

Calendar Years 1982-1987

Year	All Manufacturing Industries[a]		Aerospace Industry[b]	
	Total R&D Funds as Percent of Net Sales	Company R&D Funds as Percent of Net Sales	Total R&D Funds as Percent of Net Sales	Company R&D Funds as Percent of Net Sales
1982[r]	3.8%	2.6%	17.1%	5.0%
1983[r]	3.9	2.6	15.2	4.0
1984[r]	3.9	2.6	15.4	3.9
1985[r]	4.4	3.0	14.9	3.8
1986[r]	4.7	3.3	13.4	3.9
1987	4.8	3.2	15.0	3.7

Source: National Science Foundation.

[a] Includes all manufacturing industries known to conduct or finance research and development.

[b] Companies classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and parts.

[r] Revised.

R&D EXPENDITURES BY STATE BY INDUSTRY, 1986

(Dollars in millions)

	Total, all states	California	New York	Michigan	New Jersey	Massachusetts	Pennsylvania	Texas	Illinois	Ohio	All other states
Total, all industries	$96,305	$19,475	$7,415	$6,559	$6,141	$5,492	$4,630	$4,284	$4,261	$3,569	$34,479
Aircraft & missiles	23,506	8,265	253	NA	233	NA	1,298	NA	1,726	NA	8,595
Electrical equipment	16,920	2,913	130	353	2,295	1.528	825	1,150	1,125	240	6,361
Machinery	NA	1,711	203	1,966	174	1,754	253	471	387	410	NA
Chemicals & allied products	9,831	545	800	715	1.665	196	1,006	486	117	662	3.639
Motor vehicles	NA	NA	5,714	NA	NA	0	NA	107	NA	NA	949
Instruments	5,456	1,274	34	1,169	350	506	144	249	44	123	1,563
Petroleum refining	1,899	318	1	81	NA	NA	47	NA	422	NA	276
Food & tobacco products	1,402	95	NA	74	137	7	43	115	7	39	NA
Rubber products	NA	NA	30	15	NA	56	30	37	5	476	179
Primary metals	NA	14	37	17	59	30	254	32	NA	48	914
Nonmanufacturing	8,743	1,811	55	443	579	631	446	521	317	240	3.700
All other industries	4,024	188	NA	192	163	159	NA	386	77	334	2,141

Source: National Science Foundation, Division of Science Resources Studies

NOTE: NA indicates that data are unavailable because of Census Bureau restrictions on the publication of data that would reveal the operations of individual companies.

Total R&D funds data are unavailable for the machinery, motor vehicles, and primary metals industries because of restrictions on publishing data showing Federal R&D support to these industries. The amount of companies' own funds spent by each of these industries in 1987 was: machinery (including computers), $11.409 billion; motor vehicles, $7.265 billion; and primary metals, $744 million.

FUNDS FOR INDUSTRIAL RESEARCH AND DEVELOPMENT IN THE AEROSPACE INDUSTRY

By Type of Research and Funding Source
Calendar Years 1963-1985[a]
(Millions of Dollars)

Year	TOTAL AERO-SPACE	Basic Research			Applied Research			Development		
		Total	Federal Funds	Com-pany Funds	Total	Federal Funds	Com-pany Funds	Total	Federal Funds	Com-pany Funds
1963	$ 4,712	$ 59	$31	$28	$ 735	$ 585	$ 150	$ 3,917	$3,634	$ 283
1964	5,078	67	34	34	766	607	159	4,244	3,948	296
1965	5,148	71	41	30	735	563	172	4,342	3,921	421
1966	5,526	69	36	33	773	563	210	4,685	4,162	523
1967	5,659	71	33	38	726	490	236	4,871	4,071	[illegible]00
1968	5,765	68	26	42	677	426	251	5,021	4,145	876
1969	5,882	65	24	41	597	347	250	5,220	4,216	1,004
1970	5,219	63	20	43	565	352	213	4,591	3,718	873
1971	4,881	54	37	17	461	279	182	4,365	3,583	782
1972	4,950	60	44	16	451	267	184	4,438	3,722	716
1973	5,052	50	21	29	512	308	204	4,491	3,633	858
1974	5,278	51	19	32	609	360	249	4,617	3,735	882
1975	5,713	54	17	37	614	381	233	5,044	4,119	925
1976	6,339	54	21	33	666	365	301	5,619	4,521	1,098
1977[a]	7,033	56	25	31	753	419	334	6,223	5,017	1,206
1979	8,041	86	44	42	880	499	381	7,076	5,314	1,762
1981	11,968	131	60	71	1,484	897	587	10,353	7,738	2,615
1983	13,853	146	NA	NA	3,466	NA	NA	10,241	7,668	2,573
1984	16,033	247	NA	NA	3,067	NA	NA	12,718	9,870	2,848
1985	17,619	304	162	142	3,785	2,776	1,009	13,530	10,483	3,047

Source: National Science Foundation, plus estimates by AIA to adjust originally-published breakouts by Research Type and Funding Source to NSF's revised totals.

NOTE: Detail may not add to totals because of rounding.

[a] Break-outs by Research Type and Funding Source available only for odd-numbered years after 1977. Data for 1986 not yet available.

NA Not available.

r Revised.

FEDERAL AERONAUTICS RESEARCH AND DEVELOPMENT

Fiscal Years 1970-1988
(Millions of Dollars)

Year	TOTAL	NASA[a]	DOD[b]	DOT[c]
BUDGET AUTHORITY				
1970	$1,882	$199	$1,641	$ 42
1971	1,990	210	1,707	73
1972	2,295	236	1,964	95
1973	2,187	313	1,799	75
1974	2,030	278	1,678	74
1975	2,015	314	1,627	74
1976	2,351	325	1,941	85
Tr. Qtr.	584	83	480	22
1977	2,727	378	2,256	93
1978	3,338	437	2,807	94
1979	2,850	519	2,240	91
1980	2,991	560	2,336	95
1981	3,286	526	2,653	106
1982	3,581	516	2,984	81
1983	3,871	547	3,221	103
1984	4,087	600	3,224	263
1985	4,355	648	3,422	265
1986	6,660	601	4,927	1,132
1987[E]	6,817	698	5,173	946
1988[E]	9,234	725	7,009	1,500
OUTLAYS				
1982[d]	$3,309	$563	$2,657	$ 89
1983	3,554	563	2,920	71
1984	3,727	586	2,995	146
1985	4,010	643	3,101	266
1986	6,071	648	4,373	1,050
1987[E]	6,526	622	4,867	1,037
1988[E]	7,707	683	5,923	1,101

Source: NASA, "Aeronautics and Space Report of the President" (Annually).

[a] Research and Development, Construction of Facilities, Research and Program Management.

[b] Research, Development, Testing and Evaluation of aircraft and related equipment.

[c] Federal Aviation Administration Research, Engineering and Development, and Facilities, Engineering and Development.

[d] First year outlays data available.

[E] Estimate. Latest year reflects Administration's budget proposal.

FEDERAL OUTLAYS FOR CONDUCT OF RESEARCH AND DEVELOPMENT

Fiscal Years 1976-1990
(Millions of Dollars)

Year	TOTAL	DOD	NASA	Energy[a]	Other
CURRENT DOLLARS					
1976	$20,233	$ 9,329	$3,521	$2,225	$ 5,158
1977	22,462	10,176	3,763	3,181	5,342
1978	24,532	10,726	3,833	3,925	6,048
1979	26,578	11,454	4,064	4,413	6,648
1980	30,351	13,451	4,711	4,698	7,492
1981	34,252	15,720	5,279	5,121	8,132
1982	34,509	18,201	3,220	4,974	8,114
1983	36,560	21,057	2,538	4,771	8,193
1984	40,518	23,583	3,539	4,702	8,694
1985	45,244	27,878	2,970	4,900	9,496
1986	51,576	33,292	3,432	4,705	10,147
1987	52,862	34,581	3,250	4,682	10,349
1988	56,018	35,417	3,832	4,989	11,780
1989[E]	59,897	37,306	4,741	5,259	12,591
1990[E]	64,418	39,437	6,152	5,501	13,328
CONSTANT DOLLARS (1982 = 100)[b]					
1976	$32,592	$15,027	$5,672	$3,584	$ 8,309
1977	33,510	15,181	5,614	4,746	7,970
1978	34,205	14,955	5,344	5,473	8,433
1979	34,118	14,703	5,217	5,665	8,534
1980	35,817	15,873	5,559	5,544	8,841
1981	36,743	16,863	5,663	5,493	8,723
1982	34,509	18,201	3,220	4,974	8,114
1983[r]	35,076	20,202	2,435	4,577	7,861
1984[r]	37,451	21,798	3,271	4,346	8,036
1985[r]	40,509	24,960	2,659	4,387	8,502
1986	44,903	28,985	2,988	4,096	8,834
1987	44,806	29,311	2,755	3,968	8,772
1988	45,931	29,039	3,140	4,090	9,658
1989[E]	47,229	29,416	3,738	4,146	9,928
1990[E]	49,013	30,006	4,680	4,185	10,140

Source: "The Budget of the United States Government, Special Analyses," (Annually).

NOTE: Detail may not add to totals because of rounding.

[a] Energy research and development programs transferred from AEC to ERDA with 1974 reorganization and to Dept. of Energy in 1977.

[b] Based on Fiscal Year GNP implicit price deflator.

[E] Estimate. Latest year reflects Administration's budget proposal.

[r] Revised.

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1989-1991
(Millions of Dollars)

	1989	1990^E	1991^E
TOTAL—APPROPRIATIONS FOR RDT&E	$37,542	$41,025	$41,252
BY APPROPRIATION			
Army	$ 5,117	$ 5,603	$ 5,874
Navy	9,345	10,184	9,636
Air Force	14,679	14,772	13,784
Defense Agencies	8,181	9,996	11,353
Director of Test & Evaluation, Defense	149	316	448
Director of Operational Test & Evaluation, Defense	71	153	161
BY RESEARCH CATEGORIES			
Research	$ 955	$ 930	$ 963
Exploratory Development	2,522	2,363	2,451
Advanced Development	10,386	12,391	12,655
Engineering Development	11,620	12,586	12,654
Management and Support	2,589	2,823	2,911
Operational Systems Development	9,469	9,933	9,619
RECAP OF BUDGET ACTIVITIES			
Technology Base	$ 3,478	$ 3,293	$ 3,414
Advanced Technology Development	5,897	7,840	9,074
Strategic Programs	6,481	5,628	4,496
Tactical Programs	13,169	14,942	14,726
Intelligence and Communications	4,499	4,697	4,836
Defensewide Mission Support	4,019	4,624	4,705
RECAP OF FYDP PROGRAMS			
Strategic Forces	$ 682	$ 740	$ 547
General Purpose Forces	1,959	2,358	2,259
Intelligence and Communications	6,192	6,335	6,272
Airlift/Sealift	13	15	13
Guard and Reserve	83	30	5
Research and Development (FYDP Program 6)	28,073	31,092	31,633
Central Supply and Maintenance	200	224	244
Training, Medical and Other	—	4	4
Support of Other Nations	4	6	6
Special Operations Forces	338	222	269

Source: Department of Defense Budget, "R,D,T&E Programs (R-1)" (Annually).
NOTE Detail may not add to totals because of rounding.
a Less than $1 million.
E Estimate. Latest year reflects Administration's budget proposal.

DEPARTMENT OF DEFENSE
OUTLAYS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1972-1990
(Millions of Dollars)

Year	TOTAL, All RDT&E Functions	Air Force	Navy	Army	Other
1972	$ 7,881	$ 3,205	$2,427	$1,779	$ 470
1973	8,157	3,362	2,404	1,912	479
1974	8,582	3,240	2,623	2,190	529
1975	8,866	3,308	3,021	1,964	573
1976	8,923	3,338	3,215	1,842	528
Tr. Qtr.	2,203	830	778	437	161
1977	9,795	3,618	3,481	2,069	627
1978	10,508	3,626	3,825	2,342	715
1979	11,152	4,080	3,826	2,409	837
1980	13,127	5,017	4,382	2,707	1,021
1981	15,278	6,341	4,783	2,958	1,196
1982	17,729	7,794	5,240	3,230	1,465
1983	20,554	9,182	5,854	3,658	1,861
1984	23,117	10,353	6,662	3,812	2,289
1985	27,103	11,573	8,054	3,950	3,526
1986	32,283	13,417	9,667	3,984	5,215
1987	33,596	13,347	9,176	4,721	6,352
1988^{E}	33,126	12,905	8,339	4,539	7,343
1989^{E}	36,295	14,242	8,803	4,802	8,448
1990^{E}	38,700	NA	NA	NA	NA

Source: Department of Defense Budget (Annually).
E Estimate. Latest year reflects Administration's budget proposal.
NA Not available.

DEPARTMENT OF DEFENSE PRIME CONTRACT AWARDS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1984-1988
(Millions of Dollars)

Program Categories	1984	1985	1986	1987	1988
TOTAL—RDT&E	$18,277	$18,938	$19,812	$21,809	$22,543
Research	957	1,142	1,664	1,730	1,444
Exploratory Development	1,246	1,716	1,494	1,524	1,623
Other Development	15,616	15,432	15,870	17,964	18,937
Management & Support	459	648	784	592	538
Aircraft—TOTAL	$ 2,316	$ 2,304	$ 3,160	$ 3,561	$ 5,055
Research	95	130	591	437	139
Exploratory Development	142	139	106	103	125
Other Development	2,074	2,025	2,449	3,007	4,777
Management & Support	4	9	14	14	14
Missile and Space Systems—TOTAL	7,296	7,119	6,873	7,943	7,800
Research	14	23	22	64	106
Exploratory Development	224	385	325	356	340
Other Development	6,937	6,583	6,401	7,401	7,218
Management & Support	120	127	125	122	135
Electronics & Communications Equipment—TOTAL	4,644	4,718	4,515	4,637	3,854
Research	95	126	122	162	137
Exploratory Development	397	394	325	280	251
Other Development	4,042	4,083	3,983	4,117	3,417
Management & Support	111	115	86	79	49
All Other—TOTAL[a]	4,021	4,797	5,264	5,668	5,834
Research	753	863	930	1,06[illegible]	1,062
Exploratory Development	483	798	738	785	907
Other Development	2,561	2,741	3,037	3,439	3,525
Management & Support	224	397	559	377	340

Source: Department of Defense, "Prime Contract Awards by Service Category and Federal Supply Classification" (Annually).
NOTE: Detail may not add to totals because of rounding.
[a] "All Other" includes ships, tank-automotive, weapons, ammunition, services, and other.

DEPARTMENT OF DEFENSE
NET VALUE OF PRIME CONTRACT AWARDS OVER $25,000[a] FOR RESEARCH, DEVELOPMENT, TEST & EVALUATION

By Region and Type of Contractor
Fiscal Year 1988

REGION	TOTAL	Type of Contractor		
		Educational Institutions	Other Non-Profit Institutions[a]	Business Firms
TOTAL—Millions of Dollars	$22,209	$1,241	$1,492	$19,476
New England	$ 2,618	$ 467	$ 455	$ 1,695
Middle Atlantic	2,464	172	42	2,251
East North Central	923	86	99	738
West North Central	755	11	2	742
South Atlantic	2,736	206	379	2,151
East South Central	516	21	9	486
West South Central	1,045	47	25	973
Mountain	2,822	59	1	2,763
Pacific[b]	8,329	172	480	7,677
PERCENT OF TOTAL	100.0%	100.0%	100.0%	100.0%
New England	11.8%	37.7%	30.5%	8.7%
Middle Atlantic	11.1	13.9	2.8	11.6
East North Central	4.2	6.9	6.7	3.8
West North Central	3.4	0.9	0.1	3.8
South Atlantic	12.3	16.6	25.4	11.0
East South Central	2.3	1.7	0.6	2.5
West South Central	4.7	3.8	1.6	5.0
Mountain	12.7	4.8	0.1	14.2
Pacific[b]	37.5	13.9	32.2	39.4

Source: Department of Defense, "Prime Contract Awards by Region and State" (Annually).
NOTE: Detail may not add to totals because of rounding.

[a] Includes contracts with other government agencies.

[b] Includes Alaska and Hawaii.

MISSILE PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION[a]

By Agency, Type and Model
Fiscal Years 1988, 1989 and 1990
(Millions of Dollars)

Agency, Type and Model	1988	1989	1990
AIR FORCE			
ALCM	$ 3.4	$ —	$ —
AMRAAM[b]	46.2	—	—
*ASMS	129.2	—	—
HAVE NAP	—	10.0	—
Peacekeeper (M-X)	36.0	600.0	789.0
*SRAM II	140.0	197.0	217.0
NAVY			
*AAAM	$16.1	$30.0	$74.7
AMRAAM	—	13.3	7.7
Harm[b]	4.1	3.9	5.1
Harpoon	31.9	22.3	3.5
Hawk[d]	1.3	20.2	17.0
Penguin	14.5	7.9	6.2
RAM	10.6	7.9	5.3
Sea Lance	105.1	79.3	127.8
Sidewinder[b]	19.5	—	—
Standard	93.0	159.3	157.6
Tomahawk	46.3	58.7	17.4
Trident II	1,037.9	573.3	221.3
VLA	37.6	29.9	—
ARMY			
*Advanced Anti-Tank Weapon System	$ 33.6	$ 156.9	$ 228.3
ATACMS	100.2	76.0	46.8
Chaparral	1.5	—	—
Laser Hellfire[c]	21.1	14.9	29.1
LOS-F-H	99.0	49.1	20.2
NLOS	—	144.2	139.4
Patriot	18.3	22.6	39.2
STINGER	8.9	—	—
TOW 2[d]	18.9	24.7	20.3

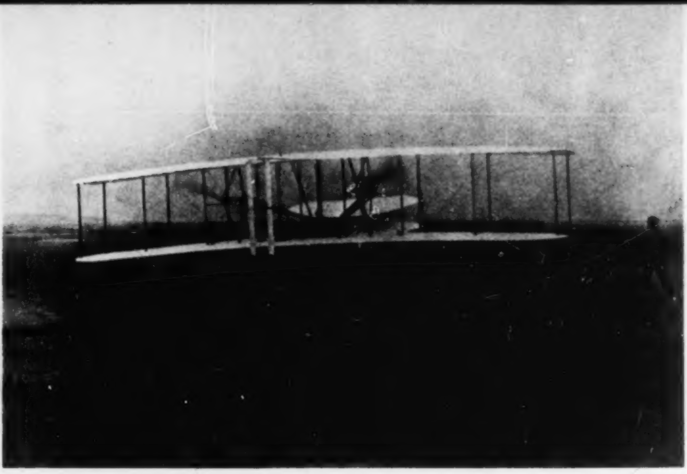
Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
NOTE: See Missile Programs Chapter for missile program procurement authorization data.
E Estimate. Latest year reflects Administation's budget proposal.
a Total Obligational Authority.
b Navy and Air Force funding.
c Army and Navy funding.
d Army and Marine Corps funding.
e Marine Corps funding.
g Navy and Marine Corps funding.
* Programs in R&D only.

MILITARY AIRCRAFT PROGRAMS RESEARCH, DEVELOPMENT, TEST AND EVALUATION[a]

By Agency, Type and Model
Fiscal Years 1988, 1989 and 1990
(Millions of Dollars)

Agency, Type and Model	1988	1989[E]	1990
AIR FORCE			
AC-130U	$ 67.3	$ 64.7	$ 37.8
*Advanced Tactical Fighter	492.3	684.6	1,111.5
*Aircraft Engine Component Improvement Program[b]	91.0	93.0	112.5
C-17	1,090.5	932.0	915.2
F-15E	99.2	87.6	124.6
F-16 Multimission Fighter (Falcon)	25.1	26.2	33.5
KC-135 Re-engining/modern	4.0	3.2	2.2
LANTIRN (Night Precision Attack)	19.8	4.7	3.5
MC-130H Combat Talon[b]	9.4	33.7	1.6
*National Aerospace Plane	182.8	230.8	299.7
TR-1/U-2	70.5	100.8	110.7
TTTS	—	4.5	3.6
NAVY			
AH-1W Sea Cobra	$ 13.1	$ 11.6	$ 18.3
AV-8B	36.5	38.8	29.5
CH/MH-53E Super Stallion	10.9	8.8	9.1
E-2C Hawkeye	21.7	22.8	38.9
E-6A	35.7	—	—
EA-6B Prowler	65.6	26.1	12.8
F-14 D Tomcat	168.0	181.3	169.9
F/A-18 Hormet	11.8	—	—
Joint Services Adv. Vert.Lift Aircraft (V-22)[b]	463.5	302.9	221.2
*LRAACA	1.8	65.8	205.1
SH-60B Seahawk (LAMPS MK-III)	18.4	1.9	1.1
T-45 Training System	94.6	88.8	26.5
ARMY			
AH-64 Attack Helicopter	$ 18.4	$ 49.5	$ 84.2
*LHX Army Helicopter	130.0	179.4	292.4
UAVs[d]	—	40.3	122.7
UH-60A Black Hawk	15.0	40.7	26.2

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
NOTE: See Aircraft Production Chapter for aircraft program procurement authorization data.
a Total Obligational Authority
b Air Force and Navy funding.
c Air Force, Navy and Marine Corps funding.
d Army, Navy and Air Force funding.
E Estimate. Latest year reflects Administration's budget proposal.
* Programs in R&D only.



Foreign Trade

In 1988, a year in which the United States as a whole experienced a merchandise trade deficit approaching $130 billion, the U.S. aerospace industry once again posted new records for export volume and trade balance.

Aerospace exports amounted to $26.9 billion up from $23.9 billion in 1987. The 1988 figure represented more than 8.7 percent of the dollar value of all U.S. exports.

U.S. imports of aerospace products climbed significantly from the $7.9 billion levels recorded in 1986 and 1987 to $9.1 billion in 1988.

The U.S. aerospace trade balance for 1988 was $17.9 billion, up from $16 billion in 1987; it marked the third consecutive record aerospace trade balance.

Similarly, aerospace exports marked a fourth straight record. The 1988 export volume of $26.9 billion represented a gain of nearly 13 percent above the previous (1987) record of $23.9 billion.

The composition of the export volume

was roughly three-quarters civil products, one-quarter military. In dollar figures, civil exports totaled $20.3 billion, military $6.7 billion. The comparable figures for the previous year were $16.2 billion civil, $7.7 billion military.

Civil exports, at $20.3 billion, achieved a dramatic increase of more than 25 percent above the 1987 level of $16.2 billion. The big gain was due primarily to a surge in deliveries of commercial transport aircraft, whose dollar value totaled $8.8 billion, by far the largest figure for a single year; the previous record (1981) was $7.2 billion.

A breakdown of civil exports categories shows sales of complete aircraft at $10.3 billion (up from $7.6 billion in 1987); aircraft and engine parts $8.4 billion (up from $7.2 billion); and aircraft engines $1.6 billion (up from $1.3 billion).

The resurgence of exports in the general aviation aircraft category that began in 1986 continued in 1988. The industry shipped 643 units with a combined dollar value of $348 million; the comparable figures for 1987 were 509 units worth $327 million.

Civil helicopter exports remained almost equal to the 1987 figure in the number of units shipped (280 in 1988, 281 in 1987) but the dollar value dipped to $219 million from $239 million.

Military exports fell off sharply from 1987's record level of $7.7 billion; military exports totaled $6.7 billion in 1988. The big decrease was in export sales of complete aircraft, which amounted to $2.2 billion in 1988, down from 1987's $3.6 billion. Sales of aircraft and engine parts increased slightly (to $3.2 billion from 1987's $3.1 billion) and sales of missiles, rockets and parts topped $1 billion (up from $848 million in 1987). Export sales of military aircraft engines also went up to $223 million from the previous year's $161 million.

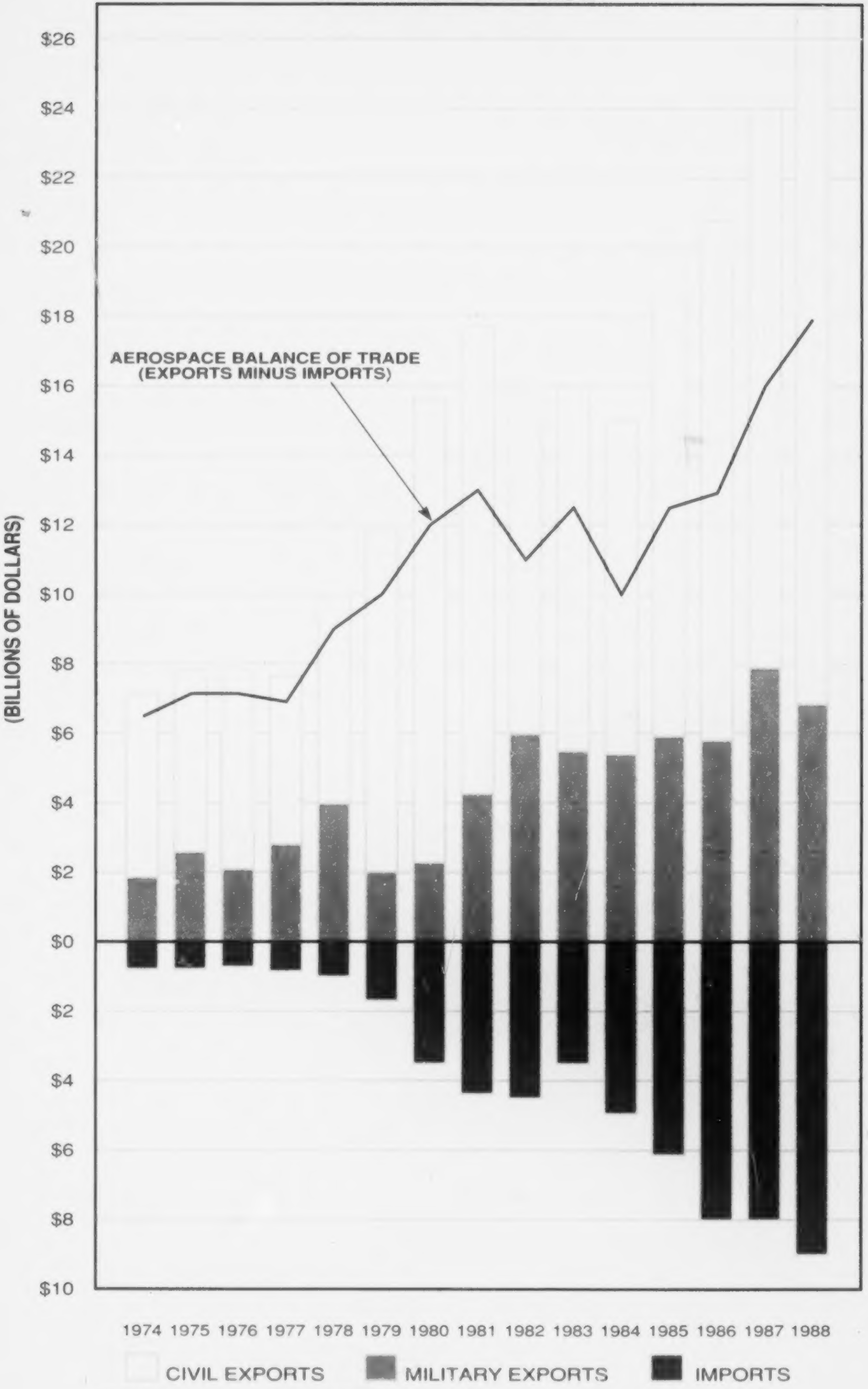
Civil products, at $7.6 billion, accounted for nearly 84 percent of U.S. aerospace imports. The breakdown: aircraft and engine parts, $4 billion (up from $3.3 billion); complete aircraft, $2.7 billion (up from $2 billion); aircraft engines, $951 million (down from $1.1 billion). Military imports of $1.5 billion (same as 1987) consisted almost entirely of aircraft and engine parts ($1.4 billion, up from $1.3 billion).

The principal customers for U.S. aerospace exports were the United Kingdom, which bought products worth $2.9 billion; Japan, $2.7 billion; France, $2 billion; Canada, $1.8 billion; West Germany, $1.4 billion; Australia, $1.2 billion; and Brazil, $0.9 billion.

France led the list of countries of origin for U.S. aerospace imports with $2.9 billion. Canada was second at $2 billion, the United Kingdom third at $1.7 billion.

AUSTRIAN
FINNAIR

AEROSPACE EXPORTS, IMPORTS AND TRADE BALANCE



Source: Aerospace Industries Association.

U.S. TOTAL AND AEROSPACE FOREIGN TRADE[a]

Calendar Years 1964-1988
(Millions of Dollars)

Year	Total U.S. Merchandise Trade			Aerospace		
	Trade Balance	Exports	Imports	Trade Balance	Exports	Imports
1964	$ 7,555	$ 26,156	$ 18,601	$ 1,518	$ 1,608	$ 90
1965	5,875	27,127	21,252	1,459	1.618	159
1966	4,524	29,884	25,360	1,370	1,673	303
1967	4,409	31,142	26,733	1,961	2,248	287
1968	1,133	34,199	33,066	2,661	2,994	333
1969	1,599	37,462	35,863	2,831	3,138	307
1970	2,834	42,590	39,756	3,097	3,405	308
1971	(2,024)[b]	43,492	45,516	3,830	4,203	373
1972	(6,351)	48,959	55,310	3,230	3,795	565
1973	1,222	70,246	69,024	4,360	5,142	782
1974	(2,996)	97,144	100,140	6,350	7,095	745
1975	9,630	106,561	96,931	7,045	7,792	747
1976	(7,786)	113,666	121,452	7,267	7,843	576
1977	(28,970)	119,006	147,976	6.850	7,581	731
1978	(33,541)	141,228	174,769	9,058	10,001	943
1979	(30,272)	178,798	209,070	10,123	11,747	1,624
1980	(27,336)	216,672	244,008	11,952	15,506	3,554
1981	(30,051)	228,961	259,012	13,134	17,634	4,500
1982	(35,182)	207,158	242,340	11,035	15,603	4,568
1983	(60,710)	195,969	256,679	12,619	16,065	3,446
1984	(110,932)	212,057	322,989	10,082	15,008	4,926
1985	(136,627)	206,925	343,552	12,592	18,724	6,132
1986	(162,281)	206,376	368,657	12,802	20,704	7,902
1987	(158,207)	243,859	402,066	16,019	23,924	7,905
1988	(129,126)	308,014	437,140	17,860	26,947	9,087

Source: Bureau of the Census, "Highlights of U.S. Export and Import Trade," Report FT990 (Monthly); "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually); "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).

[a] Total U.S. and aerospace foreign trade are reported as (1) exports of domestic merchandise, including Department of Defense shipments, f.a.s. (= free alongside ship) basis, not seasonally adjusted, (2) imports for consumption, customs value basis, not seasonally adjusted, and (3) the difference (surplus or deficit) between exports and imports.

[b] First U.S. trade deficit since 1888.

U.S. EXPORTS OF AEROSPACE PRODUCTS[a] BY MAJOR COUNTRIES OF DESTINATION

Calendar Years 1984-1988
(Millions of Dollars)

Major Countries of Destination	1984	1985	1986	1987	1988
Australia	$ 445	$1,034	$1,327	$1,036	$1,208
Belgium/Luxembourg	247	216	345	373	348
Brazil	154	407	451	912	942
Canada	1,121	964	1,005	1,103	1,804
China	128	678	334	528	425
France	1,011	1,014	1,480	1,382	2,074
Germany, West	651	967	1,282	1,274	1,415
Hong Kong	110	140	266	351	166
Israel	444	333	304	487	454
Italy	469	725	533	455	578
Japan	1,305	1,792	2,209	2,313	2,710
Korea, South	382	536	301	343	823
Netherlands	331	217	625	565	744
Saudi Arabia	419	687	670	221	235
Singapore	691	641	529	498	505
Spain	93	115	204	447	691
Sweden	156	463	419	307	627
Taiwan	264	358	238	153	164
United Kingdom	1,276	1,566	1,301	2,297	2,908

Source: U.S. Department of Commerce, International Trade Administration.

[a] Includes all civil products, f.a.s. basis; excludes military products, which are not reported by country of destination.

U.S. IMPORTS OF AEROSPACE PRODUCTS[a] BY MAJOR COUNTRIES OF ORIGIN

Calendar Years 1984-1988
(Millions of Dollars)

Major Countries of Origin	1984	1985	1986	1987	1988
Canada	$1,397	$1,552	$1,905	$1,821	$1,985
France	1,109	1,673	2,007	1,974	2,932
Germany, West	121	229	315	347	396
Israel	142	132	211	208	178
Italy	143	138	221	266	339
Japan	173	185	272	319	426
Netherlands	124	219	275	127	141
Singapore	100	114	121	115	114
Sweden	33	183	244	278	246
United Kingdom	1,163	1,562	1,898	2,004	1,738

Source: U.S. Department of Commerce, International Trade Administration.

[a] Includes civil and military products, c.i.f. basis.

U.S. IMPORTS OF AEROSPACE PRODUCTS

Calendar Years 1984-1988
(Millions of Dollars)

Aerospace Imports	1984	1985	1986	1987	1988
TOTAL	$4,926	$6,132	$7,902	$7,905	$9,087
TOTAL CIVIL	$3,787	$4,984	$6,398	$6,409	$7,604
Complete Aircraft—TOTAL	$1,301	$1,502	$2,050	$2,038	$2,702
Transports	270	599	742	551	1,125
General Aviation	612	673	1,053	1,337	1,369
Helicopters	51	45	63	79	104
Other, Including Used Aircraft, & Gliders, Balloons, & Airships	368	185	192	70	103
Aircraft Engines—TOTAL	750	1,019	1,133	1,117	951
Turbine Engines	738	1,011	1,114	1,110	951
Piston Engines	12	8	19	7	0
Aircraft and Engine Parts— TOTAL	1,736	2,463	3,215	3,254	3,951
Aircraft Parts and Accessories	320	381	594	659	2,585
Turbine Engine Parts	561	851	1,053	1,058	1,323
Piston Engine Parts	6	14	12	19	14
Spacecraft Parts, & Other Parts & Accessories	849	1,217	1,556	1,519	29
TOTAL MILITARY	$1,139	$1,148	$1,504	$1,496	$1,483
Complete Aircraft—TOTAL	$ 14	$ 20	$ 35	$ 33	$ 2
Aircraft Engines—TOTAL	124	217	286	199	106
Turbine Engines	123	215	283	196	101
Piston Engines Including Parts	1	2	3	3	5
Aircraft and Engine Parts— TOTAL	1,001	911	1,183	1,265	1,376
Aircraft Parts	632	493	690	699	869
Turbine Engine Parts	163	228	317	370	480
Other Parts & Accessories	206	190	176	196	27

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).

NOTE: Detail may not add to totals because of rounding.

U.S. IMPORTS OF COMPLETE AIRCRAFT

Calendar Years 1984-1988

Aircraft Imports	1984	1985	1986	1987	1988
TOTAL NUMBER OF AIRCRAFT	995	1,241	797	816	737
Civil Aircraft—TOTAL	951	1,166	742	630	706
New Complete Aircraft:					
Helicopters	61	60	87	98	114
General Aviation:					
Single-Engine	21	46	71	41	40
Multi-Engine Under 4400 lbs	33	8	18	1	3
Multi-Engine 4400-10,000 lbs	58	46	58	81	74
Multi-Engine, Turbojet/Turbofan, 10,000-33,000 lbs	61	54	63	76	74
Multi-Engine, Other, Including Turboshaft, 10,000-33,000 lbs	34	49	87	79	78
Transports (Multi-Engine, Over 33,000 lbs)	12	29	36	22	18
Other Civil Aircraft:					
Used or Rebuilt	223	246	141	115	194
Aircraft Previously Exported from U.S.	NA	NA	NA	NA	NA
Gliders	448	628	181	117	111
Balloons & Airships	NA	NA	NA	NA	NA
Military Aircraft—TOTAL	44	75	55	186	31
New Complete Aircraft	43	66	47	123	27
Gliders	1	9	8	63	4
Balloons & Airships	NA	NA	NA	NA	NA

(Continued on next page)

U.S. IMPORTS OF COMPLETE AIRCRAFT
(Continued)

Aircraft Imports	1984	1985	1986	1987	1988
TOTAL VALUE OF AIRCRAFT (Millions of Dollars)	$1,314.6	$1.522.0	$2,084.5	$2,070.4	$2,703.3
Civil Aircraft—TOTAL	$1,300.5	$1,501.6	$2,049.6	$2,037.7	$2,701.5
New Complete Aircraft:					
Helicopters	51.3	44.7	62.6	79.3	103.9
General Aviation:					
Single-Engine	1.5	7.5	8.1	3.1	4.5
Multi-Engine Under 4400 lbs	4.2	1.5	1.5	0.3	6.5
Multi-Engine 4400-10,000 lbs	100.1	95.1	134.9	206.7	163.6
Multi-Engine, Turbojet/Turbofan, 10,000-33,000 lbs	343.8	313.1	433.5	677.3	729.1
Multi-Engine, Other, Including Turboshaft, 10,000-33,000 lbs	162.1	255.6	475.5	449.8	465.3
Transports (Multi-Engine, Over 33,000 lbs)	269.7	598.8	741.8	551.1	1,125.4
Other Civil Aircraft:					
Used or Rebuilt	351.8	177.2[r]	189.0	60.7	92.0
Aircraft Previously Exported from U.S.	8.8	—	—	8.0	0.1
Gliders	3.6	3.8	1.7	0.6	0.5
Balloons & Airships	3.6	4.4	0.9	0.9	10.8
Military Aircraft—TOTAL	14.1	20.4	34.9	32.7	$ 1.8
New Complete Aircraft	14.0	19.4	34.0	29.8	1.6
Gliders	(*a*)	0.2	0.8	1.3	0.1
Balloons & Airships	0.1	0.8	0.1	1.6	0.1

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).
NA Not available.
a Less than $50,000.
r Revised.

TOTAL U.S. EXPORTS AND EXPORTS OF AEROSPACE PRODUCTS

Calendar Years 1964-1988
(Millions of Dollars)

Year	TOTAL Exports[a] of U.S. Merchandise	Exports of Aerospace Products				
		TOTAL	Percent of Total U.S. Exports	Civil		Military
				Total	Trans-ports	
1964	$ 26,156	$ 1,608	6.1	$ 764	$ 211	$ 844
1965	27,127	1,618	6.0	854	353	764
1966	29,884	1,673	5.0	1,035	421	638
1967	31,142	2,248	7.2	1,380	611	868
1968	34,199	2,994	8.8	2,289	1,200	705
1969	37,462	3,138	8.4	2,027	947	1,111
1970	42,590	3,405	8.0	2,516	1,283	889
1971	43,492	4,203	9.7	3,080	1,567	1,123
1972	48,959	3,795	7.8	2,954	1,119	841
1973	70,246	5,142	7.3	3,788	1,664	1,354
1974	97,144	7,095	7.3	5,273	2,655	1,822
1975	106,561	7,792	7.3	5,324	2,397	2,468
1976	113,666	7,843	6.9	5,677	2,468	2,166
1977	119,006	7,581	6.4	5,049	1,936	2,532
1978	141,228	10,001	7.1	6,018	2,558	3,983
1979	178,798	11,747	6.6	9,772	4,998	1,975
1980	216,672	15,506	7.2	13,248	6,727	2,258
1981	228,961	17,634	7.7	13,312	7,180	4,322
1982	207,158	15,603	7.5	9,608	3,834	5,995
1983	195,969	16,065	8.2	10,595	4,683	5,470
1984	212,057	15,008	7.1	9,659	3,195	5,350
1985	206,925	18,724	9.0	12,919	5,518	5,805
1986	206,376	20,704	10.0	14,834	6,276	5,870
1987	243,859	23,924	9.8	16,183	6,377	7,741
1988	308,014	26,947	8.7	20,274	8,766	6,674

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT 446 (Annually); "Highlights of U.S. Export and Import Trade," Report FT 990 (Monthly).

NOTE Detail may not add to totals because of rounding.

[a] Exports of domestic merchandise including DOD shipments.

U.S. EXPORTS OF AEROSPACE PRODUCTS

Calendar Years 1984-1988
(Millions of Dollars)

Aerospace Exports	1984	1985	1986	1987	1988
TOTAL	$15,008	$18,724	$20,704[r]	$23,924	$26,947
TOTAL CIVIL	$ 9,659	$12,919	$14,833	$16,183	$20,274
Complete Aircraft—TOTAL	$ 4,147	$ 6,694	$7,365	$ 7,649	$10,294
Transports	3,195	5,518	6,276	6,377	8,766
General Aviation[a]	268	191	243	327	348
Helicopters	234	210	277	239	219
Other, Including Used	450	775	569	706	962
Aircraft Engines—TOTAL	1,057	923	987	1,326	1,570
Turbine Engines	1,021	880	944	1,269	1,492
Piston Engines	36	43	43	57	78
Aircraft and Engine Parts Incl. Spares—TOTAL	4,455	5,302	6,481	7,208	8,409
Aircraft Parts & Accessories	3,094	3,610	4,394	4,752	5,419
Aircraft Engine Parts	1,361	1,692	2,087	2,456	2,990
TOTAL MILITARY	$ 5,350	$5,805	$5,871[r]	$ 7,741	$ 6,674
Complete Aircraft—TOTAL[b]	$ 1,581	$ 2,011	$ 2,479[r]	$ 3,590	$ 2,157
Fighters & Fighter Bombers	977	1,352	1,016	1,986	1,469
Transports	85	101	1,133[r]	1,324	212
Helicopters	83	117	123	81	198
Other, Including Used	436	441	207	200	278
Aircraft Engines—TOTAL	141	146	111	161	223
Turbine Engines	125	144	108	157	213
Piston Engines	16	2	3	4	10
Aircraft and Engine Parts Incl. Spares—TOTAL	2,666	2,823	2,624	3,142	3,237
Aircraft Parts & Accessories	2,241	2,302	2,148	2,500	2,569
Aircraft Engine Parts	425	521	476	642	668
Guided Missiles, Rockets, & Parts—TOTAL	962	825	657	848	1,056
Guided Missiles & Rockets	288	404	303	353	383
Missile & Rocket Parts	646	387	321	456	622
Missile & Rocket Engines	16	14	17	21	30
Missile & Rocket Engine Parts	12	20	16	18	21

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT 446 (Annually).

[a] All fixed-wing aircraft under 33,000 pounds.

[b] Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.

U.S. EXPORTS OF CIVIL AIRCRAFT

Calendar Years 1984-1988

Civil Aircraft Exports	1984	1985	1986	1987	1988
TOTAL NUMBER OF AIRCRAFT	1,045	1,050	1,327	1,929	2,784
Helicopters—TOTAL	233	137	210	281	280
Under 2200 lbs	155	68	104	129	161
Over 2200 lbs	78	69	106	152	119
General Aviation—TOTAL	425	484	464	509	643
Single-Engine	271	334	270	307	459
Multi-Engine, Under 4400 lbs	53	66	63	51	51
Multi-Engine, 4400-10,000 lbs	83	65	93	127	109
Multi-Engine, 10,000-33,000 lbs	18	19	38	24	24
Transports—TOTAL	83	152	159	170	217
Passenger Aircraft, Over 33,000 lbs	77	140	149	160	205
Cargo Aircraft, Over 33,000 lbs	3	6	2	4	8
Other, Over 33,000 lbs, Incl. Pass./Cargo Combi	3	6	8	6	4
Other Aircraft—TOTAL	304	277	494	969	1,644
Used or Rebuilt Aircraft	304	277	494	969	1,644
Other Aircraft, Including Balloons, Gliders & Kites	NA	NA	NA	NA	NA
TOTAL VALUE (Millions of Dollars)	$4,147	$6,694	$7,366	$7,649	$10,294
Helicopters—TOTAL	$ 234	$ 210	$ 277	$ 239	$ 219
Under 2200 lbs	45	18	29	33	30
Over 2200 lbs	189	192	248	206	189
General Aviation—TOTAL	268	191	243	327	348
Single-Engine	34	48	28	28	47
Multi-Engine, Under 4400 lbs	13	14	13	8	12
Multi-Engine, 4400-10,000 lbs	99	85	133	219	239
Multi-Engine, 10,000-33,000 lbs	122	44	69	72	49
Transports—TOTAL	3,195	5,518	6,276	6,377	8,766
Passenger Aircraft, Over 33,000 lbs	2,998	4,643	5,352	5,635	7,700
Cargo Aircraft, Over 33,000 lbs	62	334	186	208	599
Other, Over 33,000 lbs, Incl. Pass./Cargo Combi	135	541	738	534	396
Other Aircraft—TOTAL	450	775	569	706	962
Used or Rebuilt	293	333	501	563	639
Other, Including Balloons, Gliders & Kites	157	442	68	143	323

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).
NA Not available.

U.S. EXPORTS OF CIVIL HELICOPTERS

Calendar Years 1984-1988

Region of Destination	1984	1985	1986	1987	1988
TOTAL NUMBER EXPORTED	233	137	210	281	280
Canada & Greenland	8	12	12	16	17
Latin America & Caribbean	32	25	39	58	25
Europe	89	18	45	105	131
Middle East	12	6	26	16	15
Asia	62	51	54	47	52
Oceania	25	18	19	32	31
Africa	5	7	15	7	9
TOTAL VALUE (Millions of Dollars)	$233.8	$209.8	$277.3	$239.1	$218.6
Canada & Greenland	$ 4.1	$ 5.0	$ 3.2	$ 7.3	$ 5.2
Latin America & Caribbean	42.0	19.0	24.4	68.0	24.5
Europe	52.8	5.4	25.6	41.5	36.0
Middle East	16.3	24.5	78.7	61.3	70.6
Asia	107.5	141.1	125.7	48.4	68.1
Oceania	9.3	9.5	7.8	8.6	10.3
Africa	1.8	5.3	11.9	4.0	3.9

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

U.S. IMPORTS OF CIVIL HELICOPTERS

Calendar Years 1984-1988

Country of Origin	1984	1985	1986	1987	1988
TOTAL NUMBER IMPORTED	61	60	87	98	114
Canada	—	—	—	32	33
France	13	13	21	29	30
Germany	16	35	55	33	43
Italy	30	8	8	4	7
United Kingdom	2	4	3	—	1
TOTAL VALUE (Millions of Dollars)	$51.3	$44.7	$62.6	$ 79.3	$103.9
Canada	$ —	$ —	$ —	$ 18.9	$ 21.5
France	14.9	13.7	10.8	24.0	21.6
Germany	9.7	19.9	43.9	31.2	50.1
Italy	19.2	3.9	5.7	5.2	10.5
United Kingdom	7.5	7.2	2.2	—	0.2

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT246 (Annually).

U.S. EXPORTS OF GENERAL AVIATION AIRCRAFT[a]

Calendar Years 1984-1988

Region of Destination	1984	1985	1986	1987	1988
TOTAL NUMBER EXPORTED	425	484	464	509	643
Canada & Greenland	49	44	50	32	14
Latin America & Caribbean	108	175	166	97	100
Europe	113	111	146	226	322
Middle East	10	33	8	1	2
Asia	47	55	42	69	50
Oceania	62	49	33	41	125
Africa	36	17	19	43	30
TOTAL VALUE (Millions of Dollars)	$267.8	$191.1	$243.1	$327.3	$347.7
Canada & Greenland	$ 23.7	$ 15.1	$ 10.5	$ 17.2	$ 12.8
Latin America & Caribbean	33.3	44.0	48.6	51.5	114.0
Europe	60.6	57.2	92.6	150.6	126.7
Middle East	62.2	3.9	6.8	0.1	0.1
Asia	48.1	40.4	48.8	60.9	38.7
Oceania	8.6	19.4	16.7	3.3	35.8
Africa	31.3	11.1	19.0	43.7	19.6

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

[a] All fixed-wing aircraft under 33,000 pounds.

U.S. IMPORTS OF GENERAL AVIATION AIRCRAFT

Calendar Years 1984-1988

Country of Origin	1984	1985	1986	1987	1988
TOTAL NUMBER IMPORTED	207	203	297	278	269
Brazil	14	10	13	20	30
Canada	27	26	34	34	40
France	30	49	99	76	60
Israel	24	9	13	8	5
Japan	15	8	10	12	29
Netherlands	3	6	10	—	—
United Kingdom	53	58	79	80	64
Other	41	37	39	48	41
TOTAL VALUE (Millions of Dollars)	$611.7	$672.7	$1,053.5	$1,337.0	$1,369.0
Brazil	$ 23.9	$ 26.3	$ 62.8	$ 97.8	$163.9
Canada	159.6	173.1	229.8	209.6	268.6
France	95.7	83.9	196.1	510.5	532.7
Israel	85.2	33.0	54.8	30.7	24.6
Japan	14.8	7.7	8.6	12.6	23.9
Netherlands	18.2	35.0	56.9	—	—
United Kingdom	198.1	200.7	297.9	301.9	271.7
Other	16.2	113.0	146.6	173.9	83.7

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

[a] All fixed-wing aircraft under 33,000 pounds.

U.S. EXPORTS OF COMMERCIAL TRANSPORT AIRCRAFT

33,000 Pounds and Over Airframe Weight
Calendar Years 1984-1988

Region of Destination	1984	1985	1986	1987	1988
TOTAL NUMBER EXPORTED	83	152	159	170	217
Canada	6	4	2	—	10
Latin America & Caribbean	3	4	9	20	15
Europe	34	72	69	88	127
Middle East	9	8	11	7	4
Asia	23	49	35	40	41
Oceania	2	7	30	8	11
Africa	6	8	3	7	9
TOTAL VALUE (Millions of Dollars)	$3,195	$5,518	$6,276	$6,377	$8,766
Canada	$ 265	$ 84	$ 46	$ —	$ 547
Latin America & Caribbean	69	234	343	725	669
Europe	1,008	2,050	2,284	2,753	3,944
Middle East	242	438	613	185	227
Asia	1,165	2,124	1,957	2,263	2,404
Oceania	137	437	927	289	503
Africa	309	151	104	162	471

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

U.S. EXPORTS OF MILITARY AIRCRAFT[a]

Calendar Years 1984-1988

	1984	1985	1986	1987	1988
TOTAL NUMBER OF AIRCRAFT	381	313	409[r]	500	743
Fighters & Fighter Bombers	110	91	68	122	87
Transports	6	6	15[r]	106	14
Helicopters	32	38	45	39	53
New Aircraft, NEC	227	141	271	218	464
Used or Rebuilt Aircraft	6	37	10	15	125
Airships, Balloons, Gliders, etc.	NA	NA	NA	NA	NA
TOTAL VALUE (Millions of Dollars)	$1,581	$2,011	$2,479[r]	$3,590	$2,157
Fighters & Fighter Bombers	$ 977	$1,352	$1,016	$1,986	$1,469
Transports	85	101	1,133[r]	1,324	212
Helicopters	83	117	123	81	198
New Aircraft, NEC	410	357	178	135	173
Used or Rebuilt Aircraft	6	59	6	6	59
Airships, Balloons, Gliders, etc.	20	25	23	59	46

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).
NEC Not elsewhere classified.
NA Not available
[a] Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.

U.S. EXPORTS OF AIRCRAFT ENGINES

Calendar Years 1986-1988
(Millions of Dollars)

	1986		1987		1988	
	Number	**Value**	**Number**	**Value**	**Number**	**Value**
TOTAL	4,582	$1,098	5,820	$1,486	8,746	$1,792
Turbine Engines-New	801	$ 630	1,004	$ 779	1,289	$1,093
Civil	702	531	877	654	1,111	899
Military	99	99	127	125	178	194
Turbine Engines-Used	676	422	1,578	646	1,197	612
Civil	640	413	1,513	614	1,120	593
Military	36	9	65	32	77	19
Piston Engines	3,105	46	3,238	61	6,260	87
Civil, New, Under 500 HP	851	13	946	13	1,543	17
Civil, New, Over 500 HP	695	9	295	16	1,072	22
Civil, Used	1,415	21	1,747	28	2,976	38
Military	144	3	250	4	669	10

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

U.S. IMPORTS OF TURBINE AIRCRAFT ENGINES[a]

Calendar Years 1986-1988
(Millions of Dollars)

	1986		1987		1988	
	Number	**Value**	**Number**	**Value**	**Number**	**Value**
Turbine Engines	2,274	$1,397	2,136	$1,306	2,823	$1,051
Civil	1,829	1,114	1,656	1,110	2,514	951
Military	445	283	480	196	309	100

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT246 (Annually).

[a] New and used.

EXPORT-IMPORT BANK LENDING AUTHORITY AND GROSS AUTHORIZATIONS SUMMARY

Fiscal Years 1980-1989
(Millions of Dollars)

LOANS[a]

Year	Lending Authority[c]	Authorizations Summary				
		TOTAL Direct Loans[a]	Regular Loans			Discount Loans, Medium Term, and Small Business Credits
			Total Regular Loans[a]	Direct Credits	CFF[b] & Relending	
1980	$4,001	$4,578	$4,087	$4,045	$ 42	$ 491
1981	5,461	5,431	5,079	5,045	34	352
1982	4,400	3,516	3,104	3,104	(*b*)	412
1983	4,400	845	685	685	(*b*)	160
1984	3,865	1,465	1,122	1,122	(*b*)	343
1985	3,865	659	320	320	(*b*)	339
1986	1,059	578	371	371	(*b*)	207
1987	680	599	332	332	—	267
1988	693	685	465	465	—	220
1989[E]	695	NA	NA	NA	—	NA

GUARANTEES AND INSURANCE

Year	Lending Authority	Authorizations Summary		
		TOTAL Guarantees and Insurance	Guarantees	Insurance
1980	$ (*d*)	$8,032	$2,510	$5,522
1981	8,059	7,416	1,506	5,910
1982	9,220	5,832	727	5,105
1983	9,000	8,525	1,741	6,784
1984	10,000	7,151	1,333	5,818
1985	10,000	7,850	1,320	6,530
1986	11,484[f]	5,508	1,128	4,380
1987	11,355	7,958	1,514	6,444
1988	13,406	5,735	601	5,134
1989	17,866	NA	NA	NA

Source: Export-Import Bank of the United States.
NOTE: Detail may not add to totals because of rounding.

[a] Discount Loans excluded from loan lending authority limitation until FY 1981. Comparable authorization data for 1980 and prior years are therefore listed under Total Regular Loans, which include Direct Credits, CFF and Relending Loans. For 1981 and subsequent years, compare TOTAL Direct Loans authorization data with Lending Authority, both of which include Discount Loans. The value of Loans may exceed Lending Authority because of the inclusion in Loans of the full amount of Certificates of Loan Participation (COLPs), portions of which are subsequently sold to commercial banks.

[b] CFF (Cooperative Financing Facility) program discontinued after 1981.

[c] Effective 1981, lending authority includes discount loans as well as direct loans.

[d] Limitation for Guarantees and Insurance began in 1981.

[E] Estimate. Latest year represents Administration's budget proposal.

[f] Includes $1,800 million proposed I-MATCH Program, which would replace direct lending and would allow an estimated $100 million in commercial loan interest buy-down.

NA Not available.

EXPORT-IMPORT BANK
TOTAL AUTHORIZATIONS OF LOANS AND GUARANTEES AND AUTHORIZATIONS IN SUPPORT OF AIRCRAFT EXPORTS[r]

Fiscal Years 1979-1988
(Millions of Dollars)

Year	TOTAL AUTHORIZATIONS	Authorizations in Support of Aircraft Exports			
		TOTAL	Percent of TOTAL Authorizations	Commercial Jet Aircraft[a]	Other Aircraft[b]
LOANS[c]					
1979	$4,475	$1,469.4	32.8%	$1,399.4	$ 70.0
1980	4,578	1,743.3	38.1	1,692.6	50.7
1981	5,431	2,576.6	47.4	2,550.3	26.3
1982	3,516	263.9	7.5	199.1	64.8
1983	845	396.7	46.9	383.8	12.9
1984	1,465	608.0	41.5	531.8	76.2
1985	659	39.7	6.0	15.2	24.5
1986	578	54.6	9.4	46.3	8.3
1987	599	12.1	2.0	—	12.1
1988	685	—	—	—	—
GUARANTEES[d]					
1979	$ 908	$ 261.4	28.8%	$ 239.3	$ 22.1
1980	2,510	1,131.9	45.1	1,088.1	43.8
1981	1,506	562.6	37.4	533.4	29.2
1982	727	104.2	14.3	78.4	25.8
1983	1,741	629.6	36.2	601.3	28.3
1984	1,333	355.5	26.7	293.5	62.0
1985	1,320	322.4	24.4	290.0	32.4
1986	1,128	329.2	29.2	277.4	51.8
1987	1,514	808.3	53.4	768.1	40.2
1988	601	84.2	14.0	76.1	8.1

Source: Export-Import Bank of the United States.

[a] Includes complete aircraft, related engines and parts, and retrofits.

[b] Includes business aircraft, general aviation aircraft, helicopters, and related goods and services. Data revised to include Discount Loans.

[c] Loans are commitments for financing by the Export-Import Bank to foreign buyers of U.S. equipment and services, including Direct Credits, loans authorized under the Cooperative Financing Facility (CFF), (until the termination of the CFF program in 1981), and Discount Loans, which are made by the Export-Import Bank to commercial banks and which subsequently may be guaranteed by the Export-Import Bank, in which case the value of the loans is also included with Guarantees.

[d] Guarantees by the Export-Import Bank provide assurances of repayment of principal and interest on loans made by private lending institutions, such as commercial banks, for major export transactions. Excludes insurance.

[r] Revised to include Discount Loans and corrected data.

EXPORT-IMPORT BANK
SUMMARY OF COMMERCIAL JET AIRCRAFT AUTHORIZATIONS FOR LOANS[a] AND GUARANTEES[b]

Fiscal Years 1957-1988
(Values in Millions of Dollars)

Year	No. of Jet Aircraft[c]		Export Value[c]		No. of New Commitments		Gross Authorizations	
	Loans	Guarantees	Loans	Guarantees	Loans	Guarantees	Loans	Guarantees
New Authorizations:								
1957[d]-1970	519	77	$ 4,772	$ 541	159	114	$ 2,315	$ 464
1971	126	9	1,539	40	58	49	481	363
1972	145	2	1,334	9	44	29	475	183
1973	129	4	1,729	25	60	23	690	191
1974	189	—	2,195	—	79	22	895	133
1975	136	1	2,070	5	64	10	691	64
1976	77	6	1,017	139	34	11	398	87
Tr. Qtr.	15	5	219	182	6	3	94	59
1977	31	25	330	902	16	14	138	294
1978	29	5	479	253	18	5	189	77
1979	118	7	2,938	317	35	10	1,399	239
1980	136	21	3,975	901	36	24	1,693	1,088
1981	121	18	4,568	637	26	17	2,550	533
1982	11	6	441	113	5	2	199	78
1983	21	9	779	619	3	4	384	601
1984	37	8	1,023	327	7	4	532	294
1985	—	14	19	481	1	5	13	289
1986	3	14	74	451	1	9	46	277
1987	—	32	22	1,449	5	14	12	808
1988	—	2	—	97	—	3	—	76
Cumulative New Authorizations[r]	1,843	264	29,522	7,489	657	372	13,195	6,199
Transfers, Reversals, & Participation	—	—	(8)	8	4	—	(140)	(20)
Cumulative Gross Authorizations (net of Adjustments)[r]	1,843	264	29,514	7,497	661	372	13,055	6,179

Source: Export-Import Bank of the United States.

NOTE: Detail may not add to totals because of rounding.

[a] Loans are commitments for direct financing by the Export-Import Bank to foreign buyers of U.S. equipment and services, including Direct Credits and loans authorized under the Cooperative Financing Facility (CFF) until the termination of the CFF program in 1981, but excluding Discount Loans, which are made by the Export-Import Bank to commercial banks and which subsequently may be guaranteed by the Export-Import Bank, in which case the value of the loans is included with Guarantees.

[b] Guarantees by the Export-Import Bank provide assurances of repayment of principal and interest on loans made by private lending institutions, such as commercial banks, for major export transactions.

[c] For Export-Import Bank commitments including both loan and guarantee authorization, number of aircraft and export value reported under "Loans."

[d] First year of commercial jet aircraft authorizations.

[r] Revised.

EXPORT-IMPORT BANK AUTHORIZATIONS OF LOANS AND GUARANTEES IN SUPPORT OF EXPORTS OF COMMERCIAL JET AIRCRAFT

Fiscal Years 1985-1987
(Values in Millions of Dollars)

Customer (Country/Airline)	Number and Aircraft Model or Related Product	Export Value	Authorization				
			Loans (Direct Credits)				Guarantees
			Amount	Percent Coverage[a]	Interest Rate	Repayment Terms[b]	Amount
FY 1988							
TOTALS	2 aircraft	$ 94	—	—	—	—	$ 76
Bangladesh/Bangladesh Biman Corp.	1 X DC-10-30	67	—	—	—	—	50
Israel/El Al	1 X 757	27	—	—	—	—	23
Uganda/Uganda Airlines	707 Hushkit	3	—	—	—	—	3
FY 1987							
TOTALS	32 aircraft	$1,411	$ 7	—	—	—	$768
Brazil/VARIG	6 X 767	324	—	—	—	—	275
Israel/El Al	2 X 757	59	—	—	—	—	50
Japan/All Nippon	15 X 767	857	—	—	—	—	300
Mauritius/Air Mauritius	2 X 767	5	—	—	—	—	5
Mauritius/Air Marritius	spare parts for 2 X 767	16	7	42.5	9.10%	20-S	7
Nepal/Royal Nepal Airlines	2 X 757	76	—	—	—	—	64
Yugoslavia/Jugoslovenski Aerotransport	2 X 737	53	—	—	—	—	45
Yugoslavia/Aviogenex	2 x 737	18	—	—	—	—	14
Yugoslavia/Aviogenex	1 X 737	19	—	—	—	—	15

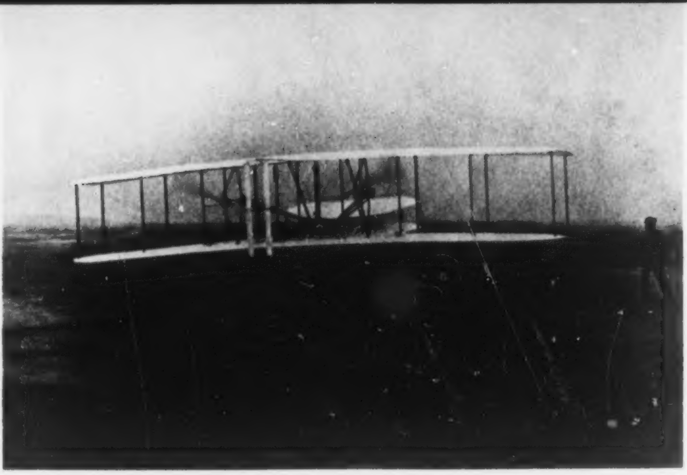
(Continued on next page)

EXPORT-IMPORT BANK LOAN AND GUARANTEE AUTHORIZATIONS (Continued)

FY 1986

TOTALS	16 aircraft	$ 525.5	$ 46.3	—	—	—	$277.4
Brazil/Ministry of Aeronautics	tools for engine overhaul	6.9	—	—	—	—	5.9
Chile/Lan-Chile, S.A.	2 X 767	96.2	—	—	—	—	40.0
Finland/Finnair	3 X MD-87	74.2	46.3	62.5	8.40	20-S	—
Gabon/Air Gabon	1 X 100-30	22.7	—	—	—	—	19.3
Jamaica/Air Jamaica	engines	4.3	—	—	—	—	3.6
Yugoslavia/Inex Adria Airways	engines	2.2	—	—	—	—	1.9
Yugoslavia/Boeing	2 X 737	69.9	—	—	—	—	59.4
Yugoslavia/McDonnell Douglas	1 x MD-82	21.8	—	—	—	—	18.6
Zimbabwe/Boeing	3 X 737	66.2	—	—	—	—	56.2
Japan/All Nippon Airways	4 X 767	161.1	—	—	—	—	72.5

Source: Aerospace Industries Association, based on data from the Export-Import Bank of the United States.
NOTE: For definitions of Loans and Guarantees, see Export-Import Bank tables on previous pages.
a Amount of loan as percent of export value.
b Number of payments and frequency (S = semi-annual)
c Reflects change from Exim guaranteed financing to non guaranteed financing.



Employment

In a year in which the aerospace industry set sales records in several categories, the industry's employment curve leveled off and average annual employment for 1988 exactly matched the previous year's figure.

Aerospace employment averaged 1,313,000 in 1988, according to estimates by Aerospace Industries Association.

That figure represented 6.7 percent of the total employment in all manufacturing industries in the United States, down from the previous year's 6.9 percent total employment among U.S. companies producing manufactured goods. It also represented 11.4 percent of total employment among U.S. companies producing durable goods; the comparable figure for 1987 was 11.7 percent.

A breakdown of the total employment figure shows that—as is traditional—more than half (53 percent) of the aerospace labor force was employed in the segment of the industry manufacturing aircraft, engines and parts.

Employment in that category totaled 699,000, down slightly from 701,000 in 1987.

In the industry segment engaged in fabrication of missiles and space systems, employment averaged 206,000, up from 204,000 in the previous year. In the catch-all "other" category that embraces all other aerospace R&D/manufacture, average employment was 408,000, the same as in 1987.

Although total employment remained constant, there was a marked (three percent) decline in production workers. The total number of production workers dropped 14,000 from the previous year's level to a 1988 average of 435,000. In aircraft, engines and parts, production workers numbered 341,000 in 1988, down from 350,000; in missiles and space systems, 62,000 (down from 66,000); and in the "other" category, 32,000 (down from 33,000).

The aerospace payroll continued to mount, but at a slower rate than in recent years. In 1988, it amounted to $34.9 billion, up 2.7 percent over the $34 billion paid in 1987; both figures include lump sum wage payments made by many aerospace firms in lieu of general wage or cost of living increases. Excluding $253 million in lump sum payments, the aerospace payroll represented 6.6 percent of combined payroll outlays by all U.S. manufacturing industries; the comparable figure for 1987 was 6.8 percent.

At $13.3 billion, payments to production workers accounted for 38 percent of the aerospace total. Average hourly earnings for production workers, again including lump sum payments, were $13.81 (up from $13.37 in 1987). Average weekly earnings amounted to $586.80 (up from $566.93). The average work week for production employees was 42.4 hours, the same as in the preceding year.

As is customary, the Pacific region dominated in a geographic breakdown of aerospace employment at yearend 1988; Pacific area companies accounted for 41.7 percent of total employment.

A distant second place was the New England region with 14.3 percent. The West North Central area placed third with 11.1 percent. Next, in order, were Middle Atlantic (7.6 percent); South Atlantic and South Central (both 7.3 percent); East North Central (5.6 percent); and the Mountain area (5.1 percent).

Pacific also dominated all categories in a breakdown of employment by product group. In civil aircraft manufacture, Pacific firms employed 58.8 percent of the labor force. New England (14.9 percent) and West North Central (10.6 percent) were second and third, respectively.

However, the geographic distribution of workers engaged in military aircraft production was more even. Pacific led with 26.9 percent, followed by New England (15.3 percent), West North Central (14.5 percent), South Central (12.9 percent), and Middle Atlantic (10.5 percent).

In space fabrication, Pacific employment amounted to 61.4 percent. Outside that region, only the South Atlantic and Mountain regions showed significant percentages (11.8 and 17.7 percent) of workers employed in the manufacture of space vehicles and equipment. In missile production, Pacific was once more the leader at 45.1 percent, New England was second at 27.6 percent and South Atlantic third with 13.6 percent.

ANNUAL AVERAGE EMPLOYMENT IN ALL MANUFACTURING, DURABLE GOODS AND AEROSPACE INDUSTRIES

Calendar Years 1977-1988
(Thousands of Employees)

Year	All Manufacturing Industries	Durable Goods Industries	Aerospace Industry[a]		
			TOTAL	As Percent of	
				All Manufacturing	Durable Goods
1977	19,682	11,597	820	4.2%	7.1%
1978	20,505	12,274	901	4.4	7.3
1979	21,040	12,760	1,034	4.9	8.1
1980	20,285	12,187	1,108	5.5	9.1
1981	20,170	12,109	1,115	5.5	9.2
1982	18,781	11,039	1,063	5.6	9.6
1983	18,434	10,732	1,043	5.6	9.7
1984	19,378	11,505	1,084	5.6	9.4
1985	19,260	11,490	1,180	6.1	10.3
1986[r]	18,994	11,244	1,251	6.6	11.1
1987[r]	19,065	11,218	1,313	6.9	11.7
1988	19,539	11,516	1,313	6.7	11.4

Source: Manufacturing and Durable Goods Employment from Bureau of Labor Statistics, "Employment and Earnings" (Monthly); Aerospace Employment from Aerospace Industries Association estimates based on "Employment and Earnings," Bureau of Labor Statistics.

NOTE: For explanation of "Aerospace Employment," see the Glossary.

[a] AIA employment data for 1977-1986 were substantially revised in 1987 to better account for aerospace industry related employment.

[r] Revised.

ANNUAL PAYROLL
AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES[d]

Calendar Years 1978-1988
(Millions of Dollars)

Year	All Manufacturing Industries[b]	Aerospace[a]			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other	
1978	299,200	$13,356	$ 5,442	$ 7,914	4.5
1979	333,900	16,830	7,184	9,646	5.0
1980	354,600	19,969	8,509	11,460	5.6
1981	385,300	22,113	9,046	13,067	5.7
1982	382,900	23,071	8,938	14,133	6.0
1983	397,400	23,243	8,948	14,295	5.8
1984[r]	439,100	26,114	9,694	16,420	5.9
1985[r]	460,900	30,370	10,807	19,563	6.6
1986[r]	470,500[r]	32,087	11,991	20,096	6.8
1987[r]	490,300	33,817	12,905	20,912	6.8
1988[E]	522,600	34,935	13,020	21,662	6.7

AEROSPACE—INCLUDING LUMP-SUM PAYMENTS[c]

Year	TOTAL	Production Workers	Other	Aerospace As Percent of All Manufacturing
1984[r]	$26,171	$ 9,751	$16,420	6.0%
1985[r]	30,451	10,888	19,563	6.6
1986[r]	32,197	12,101	20,096	6.8
1987[r]	34,030	13,118	20,912	6.9
1988	34,935	13,273	21,662	6.6

Source: Manufacturing Payroll from Bureau of Economic Analysis, "Survey of Current Business;" Aerospace Payroll from Aerospace Industries Association estimates.

[a] Based on AIA estimates of annual average employment and earnings for the aerospace industry; derived from BLS data (see Glossary, "Aerospace Employment" and "Aerospace Payroll").

[b] See Glossary, "Payroll, All Manufacturing."

[c] Many aerospace manufacturers have included lump-sum payments in labor settlements since late 1983 in lieu of general wage increases and/or cost of living adjustments. These payments are included in a separate wage series for SIC 3721 (Airframes) by the Bureau of Labor Statistics and are included in the totals for production workers and all aerospace by AIA.

[d] Aerospace employment data covering the period 1977 to 1986 were revised in 1987. As a result, aerospace payroll data over the period have been adjusted to reflect the revised employment figures.

[r] Revised.

EMPLOYMENT IN THE AEROSPACE INDUSTRY[a]

Calendar Years 1977-1988
(Annual Average, Thousands of Employees)

Year	TOTAL	Aircraft, Engines, & Parts (SIC 372)	Missiles & Space Vehicles (SIC 376)	Other
TOTAL EMPLOYMENT				
1977	820	482	83	255
1978	901	527	93	280
1979	1,034	611	102	321
1980	1,108	652	111	345
1981	1,115	646	123	347
1982	1,063	601	131	330
1983	1,043	578	141	324
1984	1,084	593	154	337
1985	1,180	636	177	367
1986[r]	1,273	678	200	396
1987[r]	1,313	701	204	408
1988	1,313	699	206	408
PRODUCTION WORKERS				
1977	295	247	26	22
1978	329	275	29	25
1979	394	332	33	29
1980	421	355	35	31
1981	410	343	37	31
1982	373	305	40	28
1983	354	283	46	26
1984	363	285	52	27
1985	395	304	62	29
1986[r]	432	333	67	32
1987[r]	449	350	66	33
1988	435	341	62	32

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.

NOTE AIA employment data for 1977-1986 were substantially revised in 1987 to better account for aerospace industry related employment.

[a] See Glossary for detailed explanation of "Aerospace Employment."

[b] Communications, navigation, flight control, and displays (aerospace-related portions of SICs 3662, 381, & 382).

[r] Revised.

EMPLOYMENT IN THE AIRCRAFT, ENGINES, AND PARTS INDUSTRY[a]

Calendar Years 1977-1988
(Annual Average, Thousands of Employees)

Year	TOTAL (SIC 372)	Airframes (SIC 3721)	Engines and Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)
TOTAL EMPLOYMENT				
1977	481.7	270.4	120.9	90.4
1978	527.2	288.3	133.5	105.5
1979	610.8	333.2	151.6	126.1
1980	652.3	349.3	162.9	140.1
1981	645.5	344.2	162.5	138.8
1982	601.1	319.9	148.8	132.3
1983	578.3	304.7	140.1	133.6
1984	592.7	306.1	140.2	146.4
1985	635.8	325.6	147.5	162.7
1986[r]	677.7	338.9	153.6	185.1
1987[r]	701.1	356.8	156.7	187.6
1988	698.7	368.8	149.6	180.3
PRODUCTION WORKERS				
1977	246.8	124.4	66.6	55.8
1978	275.4	133.9	75.3	66.2
1979	332.1	165.9	86.4	79.8
1980	354.6	173.7	93.0	88.0
1981	343.0	167.0	92.4	83.6
1982	305.4	144.7	84.2	76.6
1983	282.5	131.5	74.7	76.3
1984	284.6	128.2	73.0	83.5
1985	303.8	135.5	74.8	93.6
1986[r]	332.6	146.6	78.7	107.4
1987[r]	350.0	159.3	79.8	111.0
1988	341.0	162.2	74.1	104.7

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly).
NOTE: Detail may not add to totals because of rounding.
[a] See Glossary for detailed explanation of "Aerospace Employment."
[r] Revised.

AEROSPACE INDUSTRY EMPLOYMENT BY OCCUPATIONAL CLASSIFICATION

As of December 1977-1989
(Thousands of Employees)

Year	TOTAL[a]	Production Workers	Scientists & Engineers	Technicians	Others
1977[b]	665	280	139	46	200
1978	720	337	130	50	203
1979	842	396	146	56	244
1980	902	414	158	62	268
1981	900	399	156	69	276
1982	831	367	151	59	254
1983[b]	830	351	156	66	257
1984	850	364	160	67	259
1985	939	392	175	67	305
1986	967	446	178	66	277
1987	992	448	182	73	289
1988[p]	975	432	181	73	289
1989[E]	963	427	179	72	285

Source: Aerospace Industries Association, based on company reports and data from the Bureau of Labor Statistics.

NOTE AIA employment data for 1977-1987 were substantially revised in 1987 to better account for aerospace industry related employment and are not comparable to previously published figures. Totals for employment by occupational classification reflect only companies in SICs 372, 376, 3662, 381 and 382. As a result, they do not match the totals for aerospace employment by product group which include other industries with employment related to aerospace.

[a] End-of-year totals differ from annual averages appearing in other tables.

[b] Industry strike during this period.

[E] Estimate.

[p] Preliminary

GEOGRAPHIC DISTRIBUTION OF AEROSPACE EMPLOYMENT[a] BY OCCUPATIONAL CLASSIFICATION AND PRODUCT GROUP

As of December 1988

PERCENT DISTRIBUTION BY OCCUPATION

Region	TOTAL	Production Workers	Scientists & Engineers	Technicians	All Others
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%
New England	14.3%	19.2%	9.8%	9.6%	13.1%
Middle Atlantic	7.6	6.4	9.3	5.5	8.3
East North Central	5.6	7.6	4.4	4.1	4.6
West North Central	11.1	12.0	9.8	9.1	11.4
South Atlantic	7.3	5.3	8.5	6.2	8.9
South Central	7.3	8.3	6.7	4.4	7.4
Mountain	5.1	3.6	6.0	5.3	6.2
Pacific	41.7	37.6	45.5	55.8	40.1

PERCENT DISTRIBUTION BY PRODUCT GROUP

Region	Total	Aircraft		Missiles	Space	Other	
		Civil	Military			Aero	Non-Aero
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100%
New England	14.1%	14.9%	15.3%	27.6%	5.0%	13.4%	10.5%
Middle Atlantic	7.6	2.1	10.5	0.4		14.9	
East North Central	5.8	10.6	11.9	7.2	4.1	3.7	4.6
West North Central	11.2		14.5			17.4	6.5
South Atlantic	7.9	1.7	5.9	13.6	11.8	12.5	9.4
South Central	7.5	5.4	12.9	0.5		7.3	5.7
Mountain	5.0	6.5	2.1	5.6	17.7	30.8	63.3
Pacific	40.9	58.8	26.9	45.1	61.4		

Source: Aerospace Industries Association, company reports.

NOTE: Data for two regions are combined where employment for one region within a product group represented three or fewer companies.

[a] Employment in 40 surveyed aerospace manufacturing companies representing approximately two-thirds of total industry employment.

TOTAL EMPLOYMENT AND SCIENTISTS & ENGINEERS IN COMMERCIAL TRANSPORT AIRCRAFT & HELICOPTER MANUFACTURING ESTABLISHMENTS[a]

As of December 1977-1989

Year	Commercial Transport Aircraft		Helicopters	
	Total	Scientists & Engineers	Total	Scientists & Engineers
1977[b]	55,900	8,100	21,100	3,500
1978	58,700	8,700	24,200	3,300
1979	99,800	12,900	27,500	3,000
1980	106,500	13,700	29,800	3,200
1981	84,000	12,000	28,000	3,000
1982	69,800	11,100	26,600	3,100
1983[b]	48,200	8,400	27,600	3,500
1984	57,600	9,300	31,300	3,800
1985	58,700	10,000	34,200	4,300
1986	79,100	12,900	37,300	4,000
1987	88,100	14,400	30,500	3,300
1988[p]	94,300	14,400	28,700	3,300
1989[E]	91,800	13,600	30,100	3,500

Source: Aerospace Industries Association, company reports.

NOTE: AIA employment data for 1977-1987 were substantially revised in 1987 to better account for aerospace industry related employment.

[E] Estimate.

[a] Includes only establishments identified as prime manufacturers of commercial transport aircraft and of civil and military helicopters. Excludes subcontractors and propulsion manufacturers.

[b] Industry strike during this period.

[p] Preliminary.

AVERAGE HOURLY EARNINGS IN THE AEROSPACE INDUSTRY

Production Workers Only
Calendar Years 1974-1988

		Aircraft (SIC 372)				Guided Missiles, Space Vehicles & Parts (SIC 376)	
Year	TOTAL[a]	TOTAL	Airframes (SIC 3721)	Engines & Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)	TOTAL[a]	Guided Missiles & Space Vehicles (SIC 3761)
AVERAGE HOURLY EARNINGS[b]							
1974	$ 5.43	$ 5.42	$ 5.58	$ 5.41	$ 5.05	$ 5.48	$ 5.44
1975	6.00	6.00	6.21	6.04	5.47	6.02	5.99
1976	6.44	6.44	6.63	6.46	5.95	6.48	6.49
1977	6.93	6.92	7.07	7.05	6.44	7.04	7.15
1978	7.54	7.54	7.70	7.80	6.93	7.56	7.72
1979	8.26	8.26	8.50	8.53	7.48	8.25	8.38
1980	9.27	9.28	9.66	9.42	8.40	9.22	9.33
1981	10.29	10.31	10.74	10.41	9.35	10.06	10.34
1982	11.20	11.23	11.85	11.16	10.18[r]	10.96[r]	11.21
1983	11.79	11.82	12.58	11.61	10.73	11.61	11.86
1984	12.24	12.32	12.91	12.40	11.37	11.82	12.01
1985	12.54	12.62	13.18	12.85	11.63	12.14	12.36
1986[r]	12.75	12.86	13.48	13.08	11.90	12.20	12.48
1987[r]	13.07	13.16	13.74	13.33	12.23	12.60	12.90
1988	13.54	13.60	14.18	13.80	12.68	13.19	13.56
AVERAGE HOURLY EARNINGS INCLUDING LUMP-SUM WAGE PAYMENTS[c]							
1984[r]	$12.62	$12.72	$13.11	$12.40	$11.37	$ 12.06	$ 12.14
1985[r]	12.99	13.10	13.40	12.85	11.65	12.46	12.56
1986[r]	12.94	13.02	13.80	13.08	11.90	12.53	12.66
1987[r]	13.37	13.43	14.32	13.33	12.23	13.03	13.19
1988	13.81	13.83	14.65	13.80	12.58	13.68	13.87

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.

[a] TOTAL column is a weighted average based on BLS employment data.

[b] Includes overtime premiums.

[c] Many aerospace manufacturers have included lump-sum payments in labor settlements since late 1983 in lieu of general wage increases and/or cost of living adjustments. These payments are included in SIC 3721 as well as the totals for SIC 372 and for all aerospace.

[r] Revised.

AVERAGE WEEKLY EARNINGS IN THE AEROSPACE INDUSTRY

Production Workers Only
Calendar Years 1974-1988

		Aircraft (SIC 372)				Guided Missiles, Space Vehicles & Parts (SIC 376)	
Year	TOTAL[a]	TOTAL	Airframes (SIC 3721)	Engines & Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)	TOTAL[a]	Guided Missiles & Space Vehicles (SIC 3761)
AVERAGE HOURLY EARNINGS[b]							
1974	$221.10	$220.59	$222.08	$221.81	$213.62	$226.32	$224.67
1975	247.53	247.80	255.85	247.04	228.65	245.01	242.00
1976	263.31	263.40	273.16	259.69	245.74	262.44	260.90
1977	289.76	289.95	296.23	291.87	273.70	287.94	289.58
1978	318.05	318.19	324.17	325.26	298.68	316.76	315.75
1979	350.64	351.05	359.55	360.82	322.39	346.50	347.77
1980	388.71	389.76	403.79	393.76	357.84	378.02	383.46
1981	424.31	425.80	443.56	421.61	396.44	410.45	419.80
1982	459.99	461.55	484.67	454.21	426.54	448.26	460.73
1983	486.10	486.98	526.73	476.01	452.81	480.65	494.56
1984[r]	513.55	516.21	531.89	523.28	485.50	496.44	508.02
1985[r]	528.82	532.56	546.97	542.27	504.74	517.44	526.54
1986[r]	545.13	550.84	567.51	561.13	520.47	517.28	532.90
1987[r]	554.42	557.98	578.45	566.53	523.44	535.50	548.25
1988	575.60	576.64	595.56	582.36	543.46	569.81	585.79
AVERAGE WEEKLY EARNINGS INCLUDING LUMP-SUM PAYMENTS[c]							
1984	$518.18	$519.79	$540.13	$523.28	$485.50	$509.33	$513.52
1985[r]	536.06	537.15	556.10	542.27	505.61	530.73	535.06
1986[r]	557.86	556.77	580.98	561.13	520.03	563.16	580.98
1987	566.93	569.40	602.87	566.53	523.44	553.76	560.58
1988	586.80	586.08	615.30	582.36	543.46	590.78	599.18

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.

[a] TOTAL column is a weighted average based on BLS employment data.

[b] Includes overtime premiums.

[c] Many aerospace manufacturers have included lump-sum payments in labor settlements since late 1983 in lieu of general wage increases and/or cost of living adjustments. These payments are included in SIC 3721 as well as the totals for SIC 372 and for all aerospace.

[r] Revised.

AVERAGE HOURS IN THE AEROSPACE INDUSTRY

Production Workers Only
Calendar Years 1974-1988

AVERAGE WEEKLY HOURS

Year	TOTAL[a]	Aircraft (SIC 372)				Guided Missiles, Space Vehicles & Parts (SIC 376)
		TOTAL	Airframes (SIC 3721)	Engines & Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)	
1974	40.8	40.7	39.8	41.0	42.3	41.3
1975	41.2	41.3	41.2	40.9	41.8	40.7
1976	40.9	40.9	41.2	40.2	41.3	40.5
1977	41.8	41.9	41.9	41.4	42.5	40.9
1978	42.2	42.2	42.1	41.7	43.1	41.9
1979	42.5	42.5	42.3	42.3	43.1	42.0
1980	41.9	42.0	41.8	41.8	42.6	41.0
1981	41.3	41.3	41.3	40.5	42.4	40.8
1982	41.1	41.1	40.9	40.7	41.9	40.8
1983	41.2	41.2	40.8	41.8	42.2	41.4
1984	41.9	41.9	41.2	42.2	42.7	42.0
1985	42.2	42.2	41.5	42.2	43.4	42.3
1986	42.7	42.8	42.1	42.9	43.7	42.4
1987[r]	42.4	42.4	42.1	42.5	42.8	42.5
1988	42.5	42.4	42.0	42.2	43.2	43.2

AVERAGE WEEKLY OVERTIME HOURS

Year	TOTAL[a]	Aircraft, Engines, and Parts	Guided Missiles, Space Vehicles, and Parts
1974	3.3	3.3	3.0
1975	3.0	3.0	3.3
1976	2.7	2.7	2.7
1977	3.5	3.5	3.2
1978	4.4	4.4	4.1
1979	4.7	4.7	4.4
1980	4.1	4.2	3.6
1981	3.5	3.5	3.2
1982	3.2	3.2	3.1
1983	3.1	3.1	3.3
1984	3.9	4.0	3.3
1985	4.5	4.5	4.6
1986	4.8	4.9	4.4
1987[r]	4.8	4.9	4.2
1988	4.7	4.7	4.5

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.

[a] TOTAL column is a weighted average based on BLS employment data.

[r] Revised.

OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES[a] ALL MANUFACTURING AND AEROSPACE INDUSTRIES

Calendar Years 1983-1987

	1983	1984	1985	1986	1987
All Manufacturing:					
Total Cases	9.7	10.6	10.4	10.6	11.9
Lost Workday Cases	4.7	4.7	4.6	4.7	5.3
Nonfatal Cases without Lost Workdays	5.5	5.9	5.8	5.9	6.7
Lost Workdays	70.4	77.9	80.2	85.2	95.5
Aircraft and Parts (SIC 372):					
Total Cases	5.0	5.8	6.4	7.0	8.3
Lost Workday Cases	1.9	2.2	2.5	2.6	3.1
Nonfatal Cases without Lost Workdays	3.0	3.6	3.9	4.4	5.2
Lost Workdays	33.0	35.3	43.1	43.8	55.7
Aircraft (SIC 3721):					
Total Cases	3.8	4.5	5.4	6.6	7.4
Lost Workday Cases	1.4	1.6	2.0	2.1	2.6
Nonfatal Cases without Lost Workdays	2.4	2.9	3.5	4.5	4.8
Lost Workdays	24.6	28.3	35.8	38.3	48.0
Aircraft Engines and Parts (SIC 3724):					
Total Cases	4.6	5.3	5.2	5.4	7.1
Lost Workday Cases	2.5	2.8	2.7	2.8	3.4
Nonfatal Cases without Lost Workdays	2.1	2.5	2.5	2.6	3.7
Lost Workdays	45.6	45.9	52.0	48.0	67.4
Aircraft Parts (SIC 3728):					
Total Cases	8.0	8.9	9.4	9.0	10.8
Lost Workday Cases	2.6	2.9	3.4	3.3	3.9
Nonfatal Cases without Lost Workdays	5.4	6.1	6.0	5.7	6.9
Lost Workdays	39.0	40.0	50.1	50.1	60.4
Guided Missiles, Space Vehicles & Parts SIC 376):					
Total Cases	2.3	2.7	2.8	3.1	4.4
Lost Workday Cases	1.1	1.2	1.2	1.5	2.0
Nonfatal Cases without Lost Workdays	1.2	1.5	1.5	1.6	2.4
Lost Workdays	19.4	21.0	23.1	28.3	34.0
Guided Missiles & Space Vehicles (SIC 3761):					
Total Cases	2.1	2.5	2.5	2.8	4.3
Lost Workday Cases	1.1	1.1	1.2	1.4	2.2
Nonfatal Cases without Lost Workdays	1.0	1.3	1.3	1.4	2.2
Lost Workdays	19.4	20.0	23.0	29.5	37.4
Space Propulsion Units & Parts (SIC 3764):					
Total Cases	2.8	3.3	4.1	4.8	4.5
Lost Workday Cases	1.3	1.5	1.7	1.7	1.8
Nonfatal Cases without Lost Workdays	1.5	1.8	2.4	3.1	2.7
Lost Workdays	19.5	25.0	27.8	29.2	34.3
Other Space Vehicle Equipment (SIC 3769):					
Total Cases	3.1	3.2	3.1	3.1	4.2
Lost Workday Cases	1.0	0.9	1.1	1.3	1.2
Nonfatal Cases without Lost Workdays	2.0	2.3	2.0	1.8	3.0
Lost Workdays	19.7	22.1	20.6	21.0	16.3

Source: Department of Labor, Bureau of Labor Statistics, "Occupational Injuries and Illnesses" (Annually).

[a] Defined as the number of injuries and illnesses per 100 full-time workers. Separate incidence rates also available for occupational injuries only.

FEDERAL CIVILIAN EMPLOYMENT[a] IN THE DEPARTMENT OF DEFENSE

Fiscal Years 1967-1991

Year	TOTAL	Civil Functions[b]	Military Functions[c]
1967	1,225,637	31,980	1,193,657
1968	1,288,130	32,062	1,256,068
1969	1,257,091	31,214	1,225,877
1970	1,159,935	30,293	1,129,642
1971	1,092,804	30,063	1,062,741
1972	1,040,147	30,585	1,009,562
1973	987,281	29,971	957,310
1974	1,002,850	29,072	973,778
1975	983,790	29,069	954,721
1976	951,034	28,648	922,386
1977	940,549	28,912	911,637
1978	933,071	28,962	904,109
1979	914,582	28,592	885,990
1980	907,700	27,700	880,000
1981	981,400	34,400	947,000
1982	1,009,344	31,263	978,081
1983	1,015,779	30,973	984,806
1984	1,040,213	28,681	1,011,532
1985	1,065,551	28,681	1,036,870
1986	1,069,863	28,511	1,041,352
1987	1,059,516	28,199	1,031,317
1988[r]	1,052,848	28,267	1,024,581
1989[E]	1,045,640	28,181	1,017,459
1990[E]	1,045,427	28,115	1,017,312
1991[E]	1,041,553	27,858	1,013,695

Source: "The Budget of the United States Government" (Annually).

[a] Full-time equivalent civilian employment.

[b] Data are estimated for portions of Civil Functions.

[c] Section 904 of the 1982 Defense Authorization Act (Public Law 97-86) exempts the Department of Defense from full-time equivalent controls. Data shown are estimated civilian employment for military functions and military assistance.

[E] Estimate.

EMPLOYMENT IN NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PROGRAMS

End of Fiscal Years 1960-1989

Year	TOTAL	NASA Employees	Contractor Employees[a]
1960	46,768	10,268	36,500
1961	74,577	17,077	57,500
1962	137,656	22,156	115,500
1963	246,304	27,904	218,400
1964	379,084	31,984	347,100
1965	409,900	33,200	376,700
1966	393,924	33,924	360,000
1967	306,926	33,726	273,200
1968	267,871	32,471	235,400
1969	218,345	31,745	186,600
1970	160,850	31,350	129,500
1971	143,578	29,478	114,100
1972	138,800	27,500	111,300
1973	134,850	26,850	108,000
1974	125,220	25,020	100,200
1975	127,733	24,333	103,400
1976	130,739	24,039	108,000
1977	124,136	23,636	100,500
1978	124,637	23,237	101,400
1979	131,931	22,831	109,100
1980	135,613	22,613	113,000
1981	133,473	21,873	111,600
1982	127,952	21,652	106,300
1983	129,246	22,246	107,000
1984	162,080	22,080	140,000
1985	131,993	21,993	110,000
1986	154,800	21,800	133,000
1987	165,312	22,312	143,000
1988[E]	172,425	22,425	150,000
1989[E]	212,950	22,950	190,000

Source: NASA Briefing on the Budget of the United States (Annually), and NASA Headquarters.

[a] Includes estimates of manpower for hardware and related contracts, as well as actual work-years for support service contracts. Increase in FY 1984 caused by change in estimating methodology to reflect more accurately the mix of support and development contractors.

[E] Estimate.

AEROSPACE INDUSTRY WORK STOPPAGES[a]

Calendar Years 1979-1988

Year[b]	Number of Strikes[c]	Number of Workers Involved	Work-Days Idle in Year
1979	12	6,600	103,400
1980	17	4,400	92,900
1981	12	6,100	188,900
1982	4	11,900	45,200
1983	2	8,700	404,100
1984	4	14,600	188,200
1985	4	19,700	289,800
1986	—	—	—
1987	—	—	—
1988	3	10,600	415,800

Source: Department of Labor, Bureau of Labor Statistics, Division of Wages and Industry Relations.

a Based on SIC 372 of the 1967 Code, which includes missile and space propulsion units and parts and missile and space vehicle equipment not elsewhere classified, but which excludes complete guided missiles and space vehicles.

b Effective 1982, data not available for work stoppages involving fewer than 1,000 employees.

c Strikes beginning during calendar year.

EMPLOYMENT AND COST OF R&D SCIENTISTS AND ENGINEERS ALL INDUSTRIES AND AEROSPACE INDUSTRY

1974-1988

Year	Employment[a]			Cost per R&D Scientist and Engineer[d]	
	All Industries[b] (Thousands)	Aerospace[c] (Thousands)	Aerospace as a Percent of All Industries	All Industries[b]	Aerospace[c]
1974	360.0	70.6	19.6%	63,300	76,400
1975	363.3	67.5	18.6	66,500	85,100
1976	364.4	66.9	18.4	72,200	91,300
1977	382.8	72.0	18.8	75,800	91,300
1978	404.4	82.0	20.3	80,400	89,400
1979	423.9	86.5	20.4	87,400	93,300
1980	450.6	85.9	19.1	94,900	101,600
1981	487.8	95.2	19.5	103,900	128,400
1982[r]	509.8	91.1	17.9	112,200	148,900
1983[r]	541.9	100.6	18.6	116,400	145,300
1984[r]	586.5	107.1	18.3	125,500	159,400
1985[r]	626.2	121.3	19.4	131,400	167,600
1986[r]	676.5	132.0	19.5	130,300	159,500
1987[r]	703.8	121.0	17.2	134,700	188,000
1988	725.8	129.1	17.8	NA	NA

Source: National Science Foundation.

a Employment as of January. Scientists and engineers working less than full time have been included in terms of their full time equivalent number.

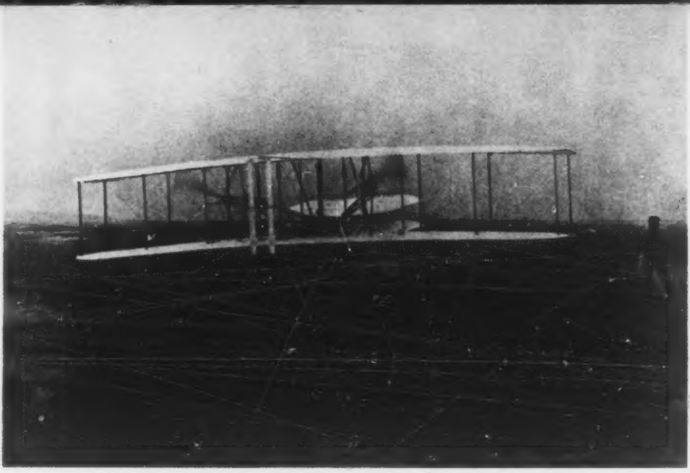
b All manufacturing industries and those non-manufacturing industries known to conduct or finance research and development.

c SIC codes 372 and 376.

d The arithmetic mean of the numbers of R&D scientists and engineers reported for January in two consecutive years, divided into the total R&D expenditures of each industry during the earlier year.

NA Not available.

r Revised.



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Finance

The aerospace industry recorded a 1988 net profit after taxes of $4.9 billion, up approximately $300 million over the previous year. In current dollars, unadjusted for inflation, the 1988 figure was an all-time high.

The aerospace profit was achieved on sales of $113 billion, which compares with $111 billion in 1987.

Despite the gain, 1988 aerospace profits were well below the averages for all U.S. manufacturing corporations whether the profit is expressed as a percentage of sales, assets or equity.

As a percentage of sales, the most frequently used yardstick, the aerospace profit rate was 4.3 percent, the all-manufacturing industry average 5.9 percent. In 1988, the national average climbed a full percentage point while the aerospace rate increased by only two-tenths of a point.

The return on assets was 4.4 percent for aerospace (same as 1987) and 6.8 percent for all manufacturing (up from 5.6 percent in 1987). The return on equity was 14.9 percent for the aerospace industry (up from 14.6 percent) and 16.1 percent (up from 12.8 percent) for all manufacturing industries.

Aerospace expenditures for new plant and equipment amounted to $3.4 billion in 1988, down from $3.5 billion in the previous year. Estimates of 1989 plant and equipment outlays indicated an increase of almost half a billion dollars to $3.9 billion.

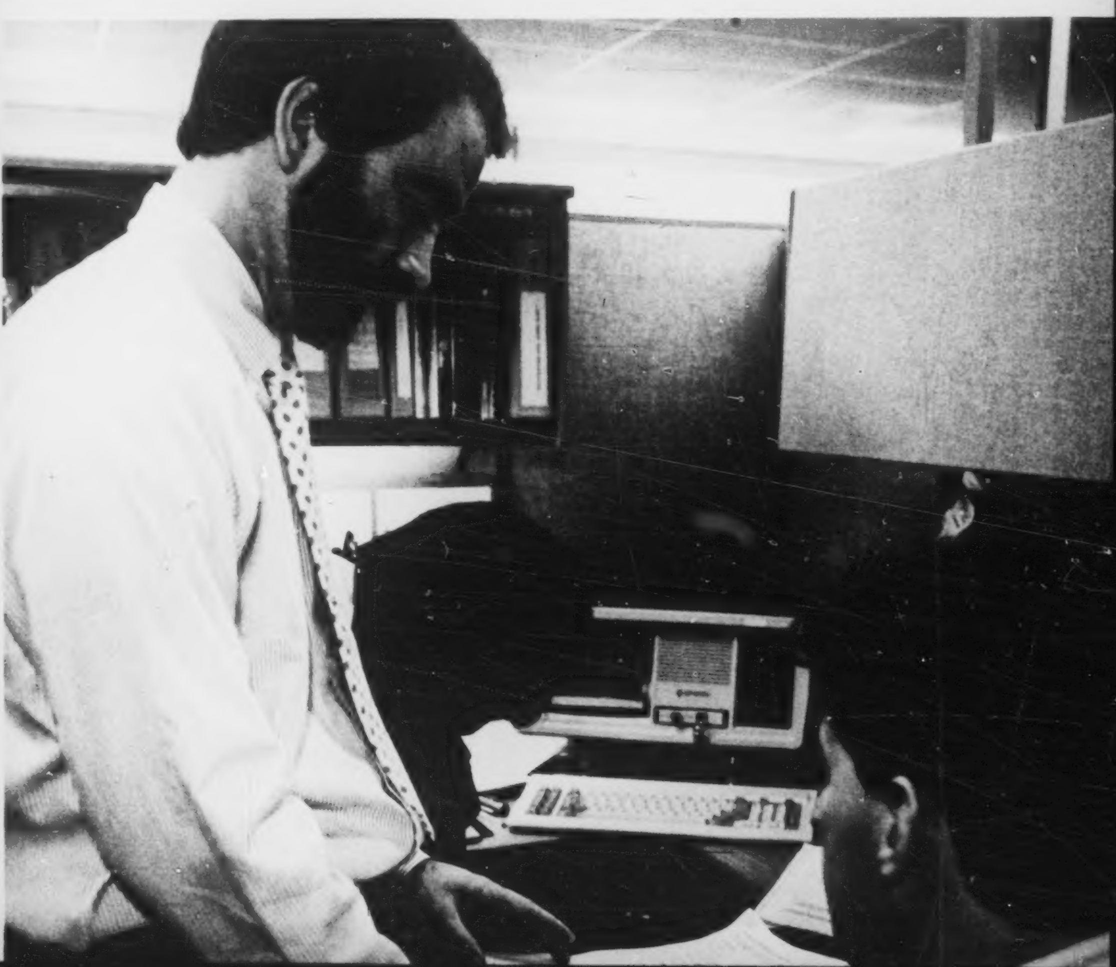
The aerospace industry's balance sheet for 1988 showed an increase in total assets to $110 billion, up from $107 billion at the end of the previous year. Net working capital increased from $9.5 billion in 1987 to $11.8 billion in 1988.

In Fiscal Year 1988, McDonnell Douglas Corporation retained its ranking as the leading contractor to the Department of Defense in terms of contract dollar value. McDonnell Douglas won contracts with an aggregate value of $8 billion. In second place was General Dynamics with $6.5 billion and General Electric Company placed third with $5.7 billion (the latter two companies similarly ranked second and third in 1987).

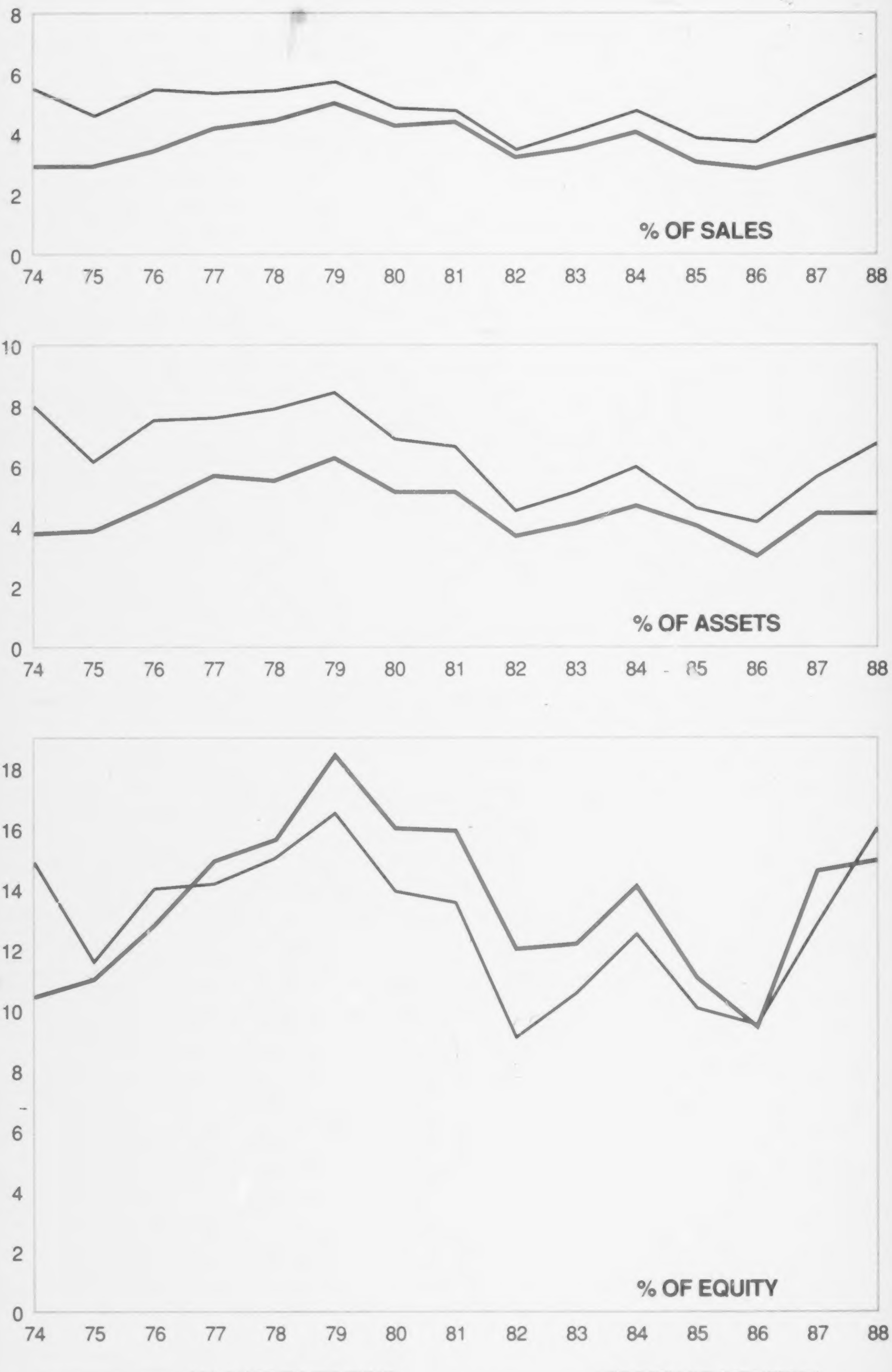
Rounding out the top 10 for 1988 were Tenneco Inc. ($5 billion); Raytheon Company ($4.1 billion); Martin Marietta Corporation ($3.7 billion); General Motors Corporation ($3.6 billion); Lockheed Corporation ($3.5 billion); United Technologies Corporation ($3.5 billion); and The Boeing Company ($3 billion). Tenneco was new to the top 10; its climb slipped Grumman Corporation ($2.8 billion) to 11th place from 10th in the previous year.

Perennial leader Rockwell International Corporation topped the list of NASA contract awards for FY 1988 with $1.7 billion. Lockheed Space Operations Company was second with $474 million and Morton Thiokol Inc. placed third with $423 million. In fourth and fifth places were Martin Marietta Corporation ($341 million) and McDonnell Douglas Corporation ($299 million).

The rest of the top 10 included The Boeing Company ($260 million); General Electric Company ($211 million); USBI Booster Production Company ($191 million); Lockheed Engineering and Science Company ($178 million); and EG&G Florida Inc. ($156 million), making its first appearance among the top 10.



NET PROFIT AFTER TAXES



Source: Aerospace Industries Association.

NET PROFIT AFTER TAXES AS A PERCENT OF SALES, ASSETS, AND EQUITY FOR ALL MANUFACTURING CORPORATIONS AND THE AEROSPACE INDUSTRY[a]

Calendar Years 1974-1988

PERCENT OF SALES

Year	All Manufacturing Corporations	Non-Durable Goods	Durable Goods	Aerospace Industry
1974	5.5%	6.4%	4.7%	2.9%
1975	4.6	5.1	4.1	2.9
1976	5.4	5.5	5.2	3.4
1977	5.3	5.3	5.3	4.2
1978	5.4	5.4	5.5	4.4
1979	5.7	6.1	5.2	5.0
1980	4.8	5.6	4.0	4.3
1981	4.7	5.1	4.3	4.4
1982	3.5	4.6	2.4	3.3
1983	4.1	4.9	3.1	3.5
1984	4.7	4.8	4.4	4.1
1985	3.8	4.1	3.4	3.1
1986[r]	3.7	4.6	2.9	2.8
1987	4.9	5.2	4.5	4.1
1988	5.9	6.6	5.2	4.3

PERCENT OF ASSETS[b] AND EQUITY[b]

Year	Percent of Assets		Percent of Equity	
	All Manufacturing	Aerospace Industry	All Manufacturing	Aerospace Industry
1974	8.0%	3.7%	14.9%	10.4%
1975	6.2	3.8	11.6	11.0
1976	7.5	4.7	14.0	12.8
1977	7.6	5.7	14.2	14.9
1978	7.8	5.5	15.0	15.7
1979	8.4	6.3	16.5	18.4
1980	6.9	5.2	13.9	16.0
1981	6.7	5.2	13.6	15.9
1982	4.5	3.7	9.2	12.0
1983	5.2	4.1	10.6	12.2
1984	5.9	4.7	12.5	14.1
1985	4.6	3.5	10.1	11.1
1986	4.2	3.0	9.5	9.4
1987	5.6	4.4	12.8	14.6
1988	6.8	4.4	16.1	14.9

Source: Bureau of the Census, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

[a] Based on a sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and propulsion and parts.

[b] Average of four quarters.

INCOME STATEMENT AND OPERATING RATIOS FOR AEROSPACE COMPANIES[a]

Calendar Years 1985-1988
(Millions of Dollars)

INCOME STATEMENT	1985	1986	1987	1988
Net Sales, Receipts, Operating Revenues	$105,853	$111,580	$110,902	$112,846
Less: Depreciation, Depletion & Amortization of Property, Plant and Equipment	3,083	3,411	3,636	3,775
Less: All Other Operating Costs & Expenses, Including Selling Costs & General & Administrative Expenses	97,752	102,568	101,053	103,098
Income (or Loss) from Operations	$ 5,018	$ 5,600	$ 6,303	$ 5,972
Net Non-Operating Income (Expense)	679	(264)	499	739
Income (or Loss) before Income Taxes (= Total Income)	$ 5,696	$ 5,337	$ 6,801	$ 6,711
Less: Provision for Current & Deferred Domestic Income Taxes	2,422	2,243	2,219	1,828
Income (or Loss) after Income Taxes (= Net Profit)	$ 3,274	$ 3,093	$ 4,582	$ 4,883
Cash Dividends Charged to Retained Earnings	1,871	1,432	1,457	1,465
Net Income Retained in Business	$ 1,403	$ 1,661	$ 3,125	$ 3,417
Retained Earnings at Beginning of Year[b]	20,558	20,475	22,128	24,139
Adjustments to Retained Earnings[c]	(1,452)	(414)	(493)	(66)
Retained Earnings at End of Year[d]	$ 20,509	$ 21,722	$ 24,882	$27,490
OPERATING RATIOS				
Income before Taxes as Percent of Net Sales	5.4%	4.8%	6.1%	5.9%
Provision for Current & Deferred Domestic Income Taxes as Percent of Income before Taxes (Total Income)	42.5	42.0	32.6	27.2
Income after Taxes (Net Profit) as Percent of Net Sales	3.1	2.8	4.1	4.3
Income after Taxes (Net Profit) as Percent of Stockholders' Equity[e]	11.1	9.4	14.6	14.4
Income after Taxes (Net Profit) as Percent of Total Assets[e]	3.5	3.0	4.4	4.5

Source: Bureau of the Census, "Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations."

NOTE: Detail may not add to totals because of rounding.

[a] Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and propulsion and parts.

[b] Beginning-of-year retained earnings for any particular year do not equal end-of-year retained earnings for the previous year because of rotation of small companies in survey sample.

[c] Other direct credits (or charges) to retained earnings (net), including stock and other non-cash dividends, etc.

[d] Retained Earnings at End of Year CALCULATED AS Retained Earnings at Beginning of Year PLUS Income (Loss) after Income Taxes MINUS Cash Dividends Charged to Retained Earnings PLUS Adjustments to Retained Earnings.

[e] Average of four quarters.

BALANCE SHEET FOR AEROSPACE COMPANIES[a]

December 31, 1985-1988
(Millions of Dollars)

	1985	1986	1987	1988
Assets:				
Current Assets				
Cash	$ 5,300	$ 4,524	$ 3,592	$ 2,156
Securities, Com'l Paper & Other Short-term Financial Investments	937	2,352	2,365	3,328
Total Cash and U.S. Gov't and Other Securities	$ 6,236	$ 6,876	$ 5,956	$ 5,484
Receivables (Total)	12,126	13,077	15,576	16,102
Inventories (Gross)	38,967	41,028	44,812	45,558
Other Current Assets	1,623	1,582	1,612	1,576
Total Current Assets	$58,952	$ 62,562	$ 67,957	$68,720
Net Plant, Property & Equipment	19,454	22,103	22,017	22,211
Other Non-Current Assets	15,161	17,748	16,882	18,614
Total Assets	$93,567	$102,414	$106,856	$109,545
Liabilities:				
Current Liabilities				
Short Term Loans	$ 2,480	$ 1,547	$ 1,551	$ 1,369
Trade Accts. & Notes Payable	8,148	8,926	9,706	10,424
Income Taxes Accrued	5,033	5,723	6,393	3,519
Installments Due on Long Term Debts	518	545	591	751
Other Current Liabilities	33,826	36,162	40,262	40,875
Total Current Liabilities	$50,007	$ 52,903	$ 58,502	$56,888
Long Term Debt	7,844	10,915	10,855	12,447
Other Non-Current Liabilities	6,020	5,701	5,807	6,342
Total Liabilities	$63,871	$ 69,520	$ 75,164	$75,676
Stockholders' Equity:				
Capital Stock	$ 9,188	$ 11,172	$ 6,810	$ 6,379
Retained Earnings	20,509	21,722	24,882	27,490
Total Stockholders' Equity	$29,696	$ 32,894	$ 31,692	$33,869
Total Liabilities & Stockholders' Equity	$93,567	$102,414	$106,856	$109,545
Net Working Capital	$ 8,945	$ 9,659	$ 9,455	$11,832

Source: Bureau of the Census, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."
NOTE: Detail may not add to totals because of rounding.
[a] Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles and propulsion and parts.

NEW PLANT AND EQUIPMENT EXPENDITURES

Calendar Years 1964-1989
(Billions of Dollars)

Year	All Industries	All Manufacturing Industries	Durable Goods	Aerospace[a]	
				Current Dollars	Constant Dollars 1982 = 100[b]
1964	$ 51.26	$ 21.23	$10.98	$0.41	$1.23
1965	59.52	25.41	13.49	0.53	1.58
1966	70.40	31.37	17.23	1.17	3.38
1967	72.75	32.25	17.83	1.25	3.50
1968	76.42	32.34	17.93	1.23	3.29
1969	85.74	36.27	19.97	1.29	3.30
1970	91.91	36.99	19.80	0.88	2.17
1971	92.91	33.60	16.78	0.63	1.48
1972	103.40	35.42	18.22	0.68	1.57
1973	120.03	42.35	22.63	0.79	1.77
1974	139.67	52.48	26.77	1.21	2.46
1975	142.42	53.66	25.37	1.19	2.12
1976	158.44	58.53	27.50	1.02	1.70
1977	184.82	67.48	32.77	1.14	1.77
1978	217.76	78.58	39.46	1.76	2.50
1979	254.96	95.92	48.50	2.70	3.49
1980	282.80	112.33	55.36	3.57	4.25
1981	315.22	126.54	59.81	3.36	3.62
1982	310.58	120.68	55.35	3.41	3.41
1983	304.78	116.20	53.08	2.91	3.06
1984	354.44	138.82	66.24	3.57	3.79
1985	387.13	153.48	73.27	3.45	3.74
1986	379.47	142.69	69.14	3.80	4.04
1987[r]	389.67	145.90	70.01	3.54	3.91
1988[r]	430.76	166.32	78.30	3.44	3.81
1989[E]	473.65	181.90	82.23	3.90	NA

Source: U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Quarterly Report.

[a] Data are company-based (not establishment- or product-based), and represent corporate entities whose principal activity falls in SIC Codes 372 and 376.

[b] Aerospace constant dollars based on BEA's industry deflator for historical data, and Durable Goods deflator for current year estimates.

[E] Estimate.

[r] Revised

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MAJOR CONTRACTORS

Fiscal Years 1984-1988
By rank according to net value of NASA prime contracts awarded during last fiscal year
(Millions of Dollars)

Company	1984	1985	1986	1987	1988
TOTAL PROCUREMENTS	$7,354	$8,298	$8,180	$8,610	$9,545
Awards to Business Firms	5,967	6,653	6,356	6,541	7,275
% of TOTAL PROCUREMENTS	81%	80%	78%	76%	76%
Rockwell International Corp.	$1,402	$1,345	$1,156	$1,610	$1,714
Lockheed Space Operations Co.	301	551	559	323	474
Morton Thiokol Inc.	322	334	320	286	423
Martin Marrietta Corp.	428	483	427	326	341
McDonnell Douglas Corp.	200	194	266	285	299
Boeing Co.	44	69	113	175	260
General Electric Co.[b]	112	145	207	225	211
USBI Booster Production Co.	197	207	196	183	191
Lockheed Engrg. & Mgmt. Co. Inc.	105	125	124	163	178
EG&G Florida Inc.	109	108	117	131	156
Allied Signal Aerospace Co.	163	150	138	142	152
Computer Sciences Corp.	89	102	96	90	151
TRW Inc.	82	103	85	124	143
Lockheed Missiles & Space Co.	102	137	121	108	141
Ford Aerospace & Communications	106	120	208	120	137
United Technologies Corp.	118	110	97	166	91
IBM Corp.	134	124	94	72	87
Contel Corp.	(*a*)	(*a*)	69	81	76
Grumman Aerospace Corp.	13	10	9	23	74
Pan American World Serv. Inc.	40	49	47	60	70
Planning Research Corp.	57	65	51	37	47
Boeing Technical Operat. Inc.	25	39	36	27	42
Teledyne Industries Inc.	52	46	48	38	40
BAMSI Inc.	6	13	19	31	40
Sverdrup Technology Inc.	8	7	15	27	38
Raytheon Service Co.	28	25	28	32	38
Perkin Elmer Corp.	79	64	24	35	31
Cray Research Inc.	8	19	10	11	31
Orbital Sciences Corp.	(*a*)	(*a*)	(*a*)	42	26
NSI Technology Serv. Corp.	(*a*)	(*a*)	(*a*)	(*a*)	25

Source: National Aeronautics and Space Administration, "NASA Annual Procurement Report," (Annually).

a Not in list of major contractors for indicated year(s).

b Includes awards previously reported for RCA Corp.

DEPARTMENT OF DEFENSE MAJOR CONTRACTORS

Fiscal Years 1984-1988
Listed by rank according to net value of prime contracts awarded during last fiscal year
(Millions of Dollars)

Company	1984	1985	1986	1987	1988
TOTAL CONTRACTS	$133,571	$150,674	$145,742	$142,483	$137,049
McDonnell Douglas Corp.	$ 7,684	$ 8,857	$ 6,586	$ 7,715	$ 8,003
General Dynamics Corp.	5,952	7,440	8,013	$ 7,041	6,522
General Electric Co.	4,514	5,891	6,847	5,802	5,701
Tenneco Inc.	749	1,250	477	2,053	5,058
Raytheon Co.	3,093	2,999	4,052	3,820	4,055
Martin Marietta Corp.	2,261	2,717	2,935	3,726	3,715
General Motors Corp.[b]	4,250	5,165	5,069	4,082	3,550
Lockheed Corp.	4,967	5,082	4,896	5,574	3,538
United Technologies Corp.	3,207	3,906	3,527	3,587	3,508
The Boeing Co.	4,654	5,458	3,556	3,547	3,018
Grumman Corp.	2,419	2,733	2,967	3,393	2,848
Litton Industries Inc.	2,441	1,528	1,663	2,035	2,561
Westinghouse Electric Corp.	1,944	1,941	1,713	1,684	2,185
Rockwell International Corp.	6,219	6,264	5,590	2,238	2,184
Unisys Corp.[c]	1,880	1,909	1,897	2,268	1,380
Honeywell Inc.	1,354	1,908	1,846	2,008	1,366
Textron Inc.	805	1,920	1,671	1,546	1,276
TRW Inc.	983	1,079	1,053	1,135	1,250
Texas Instruments Inc.	956	1,426	1,435	1,109	1,232
IBM Corp.	1,572	1,783	1,359	1,822	1,065
LTV Corp.	1,655	1,585	1,445	1,308	942
FMC Corp.	1,157	831	863	744	862
Ford Motor Co.	1,124	1,019	752	509	791
The Singer Co.	561	752	871	814	785
ITT Corp.	1,140	1,503	799	995	769
Allied Signal Inc.	759	1,348	1,043	943	711
CRS Sirrine Metcalf & Eddy JV	*(a)*	*(a)*	*(a)*	*(a)*	692
Gencorp Inc.	697	566	643	874	639
Avondale Industries Inc.[d]	587	1,156	395	270	580
AT&T Co.	768	688	914	640	565

Source: Department of Defense, "100 Companies Receiving the Largest Dollar Volume of Prime Contract Awards," (Annually).

a Not in top 100 companies for indicated year(s).

b Includes amounts previously reported for Hughes Aircraft Co.

c Includes amounts previously reported for Sperry and Burroughs Corporations

d Includes amounts previously reported for Ogden Corp.

DEPARTMENT OF DEFENSE PRIME CONTRACT AWARDS OVER $25,000 FOR SELECTED MAJOR MILITARY HARD GOODS

By Geographic Region
Fiscal Years 1986, 1987 and 1988

Program and Region	Millions of Dollars			Percent of Program Total		
	1986	1987	1988	1986	1987	1988
AIRCRAFT—TOTAL	$35,281	$29,478	$27,089	100.0%	100.0%	100.0%
New England	3,578	3,470	3,466	10.1	11.8	12.8
Middle Atlantic	4,463	3,765	3,211	12.6	12.8	11.9
East North Central	4,202	3,059	2,760	11.9	10.4	10.2
West North Central	5,015	4,820	4,307	14.2	16.4	15.9
South Atlantic	4,398	4,448	2,602	12.5	15.1	9.6
East South Central	392	352	342	1.1	1.2	1.3
West South Central	4,898	4,027	4,038	13.9	13.7	14.9
Mountain	766	1,394	880	2.2	4.7	3.3
Pacific[a]	7,659	4,145	5,482	21.5	14.1	20.2
MISSILE & SPACE SYSTEMS—TOTAL	$21,510	$21,631	$21,450	100.0%	100.0%	100.0%
New England	3,950	3,443	3,324	18.4	15.8	15.5
Middle Atlantic	1,036	1,262	1,354	4.8	5.8	6.3
East North Central	173	193	167	0.8	0.9	0.8
West North Central	1,264	1,209	1,108	5.9	5.6	5.2
South Atlantic	1,863	1,424	1,612	8.7	6.6	7.5
East South Central	615	627	828	2.9	2.9	3.9
West South Central	1,977	1,516	1,416	9.2	7.0	6.6
Mountain	2,469	3,588	3,420	11.5	16.6	15.9
Pacific[a]	8,162	8,390	8,219	37.9	38.8	38.8
ELECTRONICS & COMMUNICATIONS EQUIPMENT—TOTAL	$21,050	$23,886	$18,588	100.0%	100.0%	100.0%
New England	2,135	2,819	1,730	10.1	11.8	9.3
Middle Atlantic	4,373	4,281	3,429	20.8	17.9	18.4
East North Central	1,715	1,715	1,275	7.2	7.2	6.9
West North Central	1,502	1,489	1,030	7.1	6.2	5.5
South Atlantic	5,192	6,345	5,006	24.7	26.6	26.9
East South Central	126	136	124	0.6	0.6	0.7
West South Central	963	926	1,208	4.6	3.9	6.5
Mountain	847	1,042	1,038	4.0	4.4	5.6
Pacific[a]	4,697	5,134	3,747	22.3	21.5	20.2

Source: Department of Defense, "Prime Contract Awards by Region and State" (Annually).
NOTE: Detail may not add to totals because of rounding.
[a] Includes Alaska and Hawaii.

Glossary

Aeronautics: the science that treats of the operation of aircraft, also, the art or science of operating aircraft.

AIA: Aerospace Industries Association of America, Inc., formerly Aircraft Industries Association.

Aerospace Industry: the industry engaged in research, development and manufacture of aerospace systems, including manned and unmanned aircraft; missiles, space launch vehicles, and spacecraft; propulsion, guidance and control units for all of the foregoing; and a variety of airborne and ground based equipment essential to the test, operation, and maintenance of flight vehicles.

Aerospace Employment: annual average calculated as one-twelfth of sum of monthly estimates of total number of persons employed during a designated pay period by the aircraft and missile and space industries (SIC 372 and 376) plus estimated aerospace-related employment in the communications equipment (SIC 3662) and instruments (SIC 381 and 382) industries and in certain other industries (SIC 28, 35, 73, 89, etc.).

Aerospace Payroll: estimated on the basis of average weekly earnings for a given calendar year for production workers plus an estimated annual salary for other employees.

Aerospace Sales: the AIA estimate of aerospace industry sales, developed by summing DOD expenditures for aircraft, missiles, and space-related procurement and RDT&E; NASA expenditures for research and development, and space flight control and data communications; outlays for space activities by other U.S. Government departments and agencies; commercial sales of space-related products; net domestic and export sales of civil aircraft, engines, and parts; FMS and commercial exports of military aircraft, missiles, propulsion, and related parts; and sales of related products and services, including electronics, software, and ground support equipment, plus sales of non-aerospace products which are produced in aerospace-manufacturing establishments and which use technology, processes, and materials derived from the aerospace industry. See also Related Products and Services.

Air Carriers: the commercial system of air transportation, consisting of domestic and international scheduled and charter service.

Aircraft: all airborne vehicles supported either by buoyancy or by dynamic action. Used in this volume in a restricted sense to mean an airplane—any winged aircraft, including helicopters but excluding gliders and guided missiles.

Aircraft Agreement (Agreement on Trade in Civil Aircraft): negotiated in the Tokyo Round of the Multilateral Trade Negotiations, and implemented January 1, 1980, providing for elimination of tariff and non-tariff trade barriers in the civil aircraft sector.

Aircraft Industry: the industry primarily engaged in the manufacture of aircraft, aircraft engines and parts, aircraft propellers and parts, and aircraft parts and auxiliary equipment. A sector of the **Aerospace Industry.**

Airframe: the structural components of an airplane, such as fuselage, empennage, wings, landing gear, and engine mounts, but excluding such items as engines, accessories, electronics and other parts that may be replaced from time to time.

Airlines: see **Air Carriers.**

Appropriation (Federal Budget): an act of Congress authorizing an agency to incur obligations and make payments out of funds held by the Department of the Treasury.

Assets, Net: the sum of all recorded assets after reducing such amount by allowance of reserve for bad debts, depreciation and amortization, but before deducting any liabilities, mortgages or other indebtedness.

Astronautics: the art and science of designing, building and operating manned or unmanned space objects.

Average Weekly Hours: average hours for which pay was received; different from standard or scheduled hours.

Avionics: Communications, navigation, flight controls, and displays.

Backlog: the sales value of orders accepted (supported by legal documents) that have not yet passed through the sales account.

Budget Authority: authority provided by the Congress; mainly in the form of **Appropriations,** which allows Federal agencies to incur obligations to spend or lend money.

Bureau of the Census: an agency of the Department of Commerce.

Bureau of Economic Analysis (BEA): an agency of the Department of Commerce.

Bureau of Labor Statistics (BLS): an agency of the Department of Labor.

Constant Dollars, see **Deflator.**

Deflator: index used to convert a price level to one comparable with the price level at a different time, offsetting the effect of inflation. The base period, which equals 100, is usually specified as either a given fiscal or calendar year. **Constant Dollars** are calculated by dividing current ('then-year') dollars by appropriate price deflator, and multiplying by 100.

Depreciation: the general conversion of the depreciable cost of a fixed asset into expense, spread over its remaining life. There are a number of methods, all based on a periodic charge to an expense account and a corresponding credit to a reserve account.

Development: the process or activity of working out a basic design, idea or piece of equipment (see **Research**).

DOD: Department of Defense.

DOE: Department of Energy.

DOT: Department of Transportation.

Durable Goods Industry: comprised of major manufacturing industry groups with SIC Codes 24, 25, and 32-39. All major manufacturing industry groups in SIC Codes 20-23 and 26-31 are considered nondurable goods manufacturing industry groups.

Earnings: the actual return to the worker for a stated period of time. Irregular bonuses, retroactive items, payments of various welfare benefits, and payroll taxes paid by employers are excluded.

Average Hourly Earnings: on a "gross" basis, reflecting not only changes in basic hourly and incentive wage rates, but also such variable factors as premium pay for overtime and late shift work, and changes in output of workers paid for an incentive plan.

Average Weekly Earnings: derived by multiplying average weekly hours by hourly earnings.

ERDA: Energy, Research and Development Administration. ERDA was formed in 1974 to bring together activities previously scattered among several agencies. The major elements covered were nuclear energy, fossil energy, solar and geothermal energy, conservation through increased efficiency and environmental controls. Most of these functions were assumed by the Department of Energy as of October 1, 1977.

Establishment: the basis for reporting to the Census of Manufacturers; an operating facility in a single location.

Evaluation: (Department of Defense): determination of technical suitability of material, equipment or a system; see **RDT&E.**

Expenditures (Federal Budget): see **Outlays.**

Exports: domestic merchandise including commodities which are grown, produced, or manufactured in the United States, and commodities of foreign origin which have been changed in the United States from the form in which they were imported, or which have been enhanced in value by further manufacture in the United States, and which are traded or sold to other nations.

Export-Import Bank of the United States (Eximbank): created in 1934, and established as an independent U.S. Government Agency in 1945, Eximbank is designed ". . . to aid in financing and to facilitate exports . . ." Eximbank receives no appropriations from the U.S. Congress. It is directed by statute to (1) offer financing that is competitive with that offered exporters of other countries by their official export credit institutions, (2) determine that the transactions supported provide for a reasonable assurance of repayment, (3) supplement, but not compete with private sources of export financing, and (4) take into account the effect of its activities on small business, the domestic economy, and U.S. employment.

FAA: Federal Aviation Administration (formerly the Federal Aviation Agency), an agency of the Department of Transportation.

Facility: a physical plant or installation including real property, building, structures, improvements and plant equipment.

Fiscal Year (Federal Budget): until June 30, 1976, year beginning July 1 and ending June 30, and designated by the year in which it ends. Beginning October 1, 1976, the fiscal years run from October 1 through September 30 and are designated by the year in which they end. A three month **Transition Quarter** from July 1 through September 30, 1976, belongs to neither fiscal year.

Flyaway Value: includes the cost of the airframe, engines, electronics, communications, armament and other installed equipment.

Foreign Military Sales (FMS): export sales to foreign governments arranged through the Department of Defense, whereby DOD recovers full purchase price and administrative costs; often mistakenly used to include foreign military aid and foreign commercial sales as well.

FY: see **Fiscal Year.**

General Agreement on Tariff and Trade (GATT): a multilateral treaty, subscribed to by over 80 governments which together account for more than four-fifths of world trade; its aim is to liberalize world trade; the only multilateral instrument that lays down agreed rules for international trade.

General Aviation: all civil flying except that of air carriers.

GNP (Gross National Product): the market value of the total output of goods and services produced by the nation's economy before deduction of depreciation charges and other allowances for business and institutional consumption of durable goods. It includes the purchase of goods and services by consumers and government, gross private domestic investment and net exports.

Helicopter: a rotary-wing aircraft which depends principally for its support and motion in the air upon the lift generated by one or more power-driven rotors, rotating on substantially vertical axes. A helicopter is a **V/STOL.**

Heliport: an area, either at ground level or elevated on a structure, that is used for the landing and take-off of **helicopters** and includes some or all of the various facilities useful to helicopter operations such as helicopter parking, hangar, waiting room, fueling and maintenance equipment.

Helistop: a minimum facility **heliport,** either at ground level or elevated on a structure for the landing and takeoff of **helicopters** but without such auxiliary facilities as waiting room, hangar parking, etc.

ICBM: Intercontinental Ballistic Missile, with a range of more than 5,000 miles.

Imports: classified as "general imports" or "imports for consumption." This volume refers generally to "imports for consumption," which are entries for immediate consumption plus merchandise withdrawn from bonded storage warehouses for consumption. Data are compiled from Import Entries filed with U.S. Customs officials, and are in general based on the market value or price in the foreign country at the time of exportation of such merchandise, including the cost of containers and coverings, as well as other charges and expenses incidental to placing the merchandise in condition, packed and ready for shipment to the United States, but excluding import duties, insurance, freight and other charges incidental to arrival of the goods in the United States. The foreign values of imported merchandise are converted into U.S. currency at the rate of exchange prevailing on the day the merchandise is shipped to the United States.

Income:

Net Operating Income: total net sales (**see Sales**) less total operating costs.

Net Income (Before Income Taxes): **Net Operating Income** plus or minus **"Other Income and Expenses."**

Other Income and Expenses: includes interest income, royalty income, capital gains and losses, interest expense, cash discounts, etc.

Net Income (After Income Taxes): **Net Income (Before Taxes)** less federal income taxes.

Lump-Sum Wage Payment: a one time payment given in lieu of general wage increases and/or cost of living adjustments in labor settlements.

Manufacturing Industries: those **establishments** engaged in the mechanical or chemical transformation of inorganic or organic substances into new products, and usually described as plants, factories, or mills, which characteristically use power-driven machines and materials-handling equipment; also establishments engaged in assembling component parts of manufactured products if the new product is neither a structure nor other fixed improvement.

Merchandise Trade Balance: the difference between the value of U.S. goods exported to other countries and foreign goods imported into this country. The trade balance is generally regarded as "favorable" when **exports** exceed **imports**—a trade surplus—and "unfavorable" when **imports** exceed **exports**—a trade deficit.

Missile: sometimes applied to space launch vehicles, but more properly connotes automated weapons of warfare, *i.e.*, a weapon which has an integral system of guidance, as opposed to the unguided rocket.

Multilateral Trade Negotiations (MTN): a forum within the **GATT** in which countries negotiate to overcome their trade problems. In September 1973, in Tokyo, over 100 nations launched new multilateral trade negotiations, called the "Tokyo Round," covering both tariff and non-tariff barriers to trade in industrial and agricultural products, and improvements in the **GATT** itself.

NASA: National Aeronautics and Space Administration.

NATO: North Atlantic Treaty Organization.

New Obligational Authority (Federal Budget): see **Budget Authority.**

Non-Aerospace Products and Services: products and services other than aircraft, missiles, space vehicles, and related propulsion and parts, produced or performed by establishments whose principal business is the development and/or manufacture of aerospace products.

OASD: Office of the Assistant Secretary of Defense.

Obligations (Federal Budget): commitments made by Federal agencies to pay out money for products, services or other purposes—as distinct from the actual payments. Obligations incurred may not be larger than **budget authority.**

Orders, Net New: the sales value of new orders (supported by legal documents) minus cancellations during the period.

Other Aerospace Products and Services: all conversions, modifications, site activation, and other aerospace products (including drones) and services, plus research and development under contract, defined as basic and applied research in the sciences and in engineering, and design and development of prototype products and processes.

Outlays: checks issued, interest accrued on the public debt, or other payments made, net of refunds and reimbursements.

Overtime Hours: that portion of the gross average weekly hours which was in excess of regular hours and for which premium payments were made.

Payroll, All Manufacturing: includes the gross earning paid in the calendar year to all employees on the payroll of operating manufacturing **establishments.** Includes all forms of compensation paid directly to workers such as salaries, wages, commissions, dismissal pay, all bonuses, vacation and sick leave pay, and compensation in kind, prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, union dues, and savings bonds. Does not include employers' Social Security contributions or other non-payroll labor costs such as employees' pension plans, group insurance premiums, and workmen's compensation.

Passenger-Mile: one passenger moved one mile.

Procurement: the process whereby the executive agencies of the Federal Government acquire goods and services from enterprises other than the Federal Government.

Production Workers: includes working foremen and all non-supervisory workers (including leadmen and trainees) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, janitorial services, product development, auxiliary production for plant's own use and record keeping and services closely associated with the above production operations.

R&D: Research and Development.

Research: systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either **basic** or **applied** according to the objectives of the sponsoring agency.

Basic Research: with the objective of gaining fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Applied Research: with the objective of gaining knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Development: the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems, or methods including design and development of prototype and processes.

Independent Research and Development (IR&D): a term devised by the Department of Defense and used by Federal agencies to differentiate between a contractor's research and development technical effort performed under a contract, grant, or other arrangement (R&D) and that which is self-initiated and self-funded (IR&D).

Industrial Research and Development: research and development work performed within company facilities, funded by company or Federal funds, and excluding company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other non-profit organizations.

RDT&E: (Department of Defense): Research, Development, Test and Evaluation.

Related Products and Services: Sales of electronics, software, and ground equipment in support of aerospace products, plus sales by aerospace manufacturing establishments of systems and equipment which are generally derived from the industry's aerospace technological expertise in design, materials, and processes, but which are intended for applications other than flight.

Research: see **R&D.**

Rotorcraft: an aircraft which in all its usual flight attitudes is supported in the air wholly or in part by a rotor or rotors, *i.e.*, airfoils rotating or revolving about an axis (see **Helicopter**).

Sales: net of returns, allowances, and discounts, the dollar value of shipments, including dealer's commission, if any, which have passed through the sales account.

Satellite: a body that revolves around a larger body, such as the moon revolving around the earth, or a man-made object revolving about any body such as the sun, earth, or moon.

SIC (Standard Industrial Classification): a system developed by the U.S. Government to define the industrial composition of the economy, facilitating comparability of statistics. See **Aerospace Industry** for explanation of SIC codes applicable to the aerospace industry.

Space Vehicle: an artificial body operating in outer space (beyond the earth's atmosphere).

Stockholder's Equity: **assets** minus all obligations of the corporation, except those to stockholders. Annual data are average equity for the year (using four end-of-quarter figures.) For details, see "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations," compiled by the Bureau of the Census.

STOL: short take-off and landing aircraft.

Test (Department of Defense): an experiment designed to assess progress in attainment or accomplishment of development objectives (see **RDT&E**).

Thrust: the driving force exerted by an engine, particularly an aircraft or missile engine, in propelling the vehicle to which it is attached.

Ton-Mile: one ton moved one mile.

Total Obligational Authority: the sum of **budget authority** granted or requested from the Congress in a given year, plus unused **budget authority** from prior years.

Trade Balance: see **Merchandise Trade Balance.**

Transition Quarter (Tr. Qtr.): the three-month interval from July 1, 1976 to September 30, 1976. See **Fiscal Year.**

Turbine, Turbo: a mechanical device or engine that spins in reaction to a fluid flow that passes through or over it. Frequently used in "turboprop" or "turbojet."

U.K.: United Kingdom.

U.S.: United States of America.

USA: United States Army, an agency of the U.S. Department of Defense.

USAF: United States Air Force, an agency of the U.S. Department of Defense.

USN: United States Navy, an agency of the U.S. Department of Defense.

USSR: Union of Soviet Socialist Republics.

Utility Aircraft: an aircraft designed for general purpose flying.

V/STOL: vertical short take-off and/or landing aircraft.

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The Boeing Company
Celion Carbon Fibers
  A Division of BASF Structural
  Materials, Inc.
Chrysler Technologies Corporation
Colt Industries Inc
  Chandler Evans Inc
  Menasco Inc
  Delavan Corporation
  Lewis Engineering
E-Systems, Inc.
Fairchild Industries, Inc.
  Banner Industries
Fairchild Space and Defense Corporation
FMC Corporation
General Dynamics Corporation
General Electric Company
General Motors Corporation
  Hughes Aircraft Company
  Allison Gas Turbine Division
The BF Goodrich Company
Grumman Corporation
Harris Corporation
Heath Tecna Aerospace Company
Hercules Incorporated
Hexcel Corporation
Honeywell Inc.
IBM Corporation
  Systems Integration Division
The Interlake Corporation
ISC Defense & Space Group, Inc.
  ISC Marquardt
  ISC Defense Systems
  ISC Cardion Electronics
  ISC Electro-Magnetic Processes
  ISC Datacom/Microwave
ITT Defense Technology Corporation
Kaman Aerospace Corporation
Lear Astronics Corporation
Lockheed Corporation
Lord Corporation
The LTV Corporation
Lucas Aerospace, Inc.
Martin Marietta Corporation
McDonnell Douglas Corporation
Northrop Corporation
Ontario Corporation
Parker Hannifin Corporation
Precision Castparts Corporation
Raytheon Company
Rockwell International Corporation
Rohr Industries, Inc.
SLI Avionic Systems Corp. —
  Smiths Industries
Sundstrand Corporation
Teledyne CAE
Texas Instruments Incorporated
  Defense Systems &
  Electronics Group
Textron Inc.
Thiokol Corporation
TRW Inc.
United Technologies Corporation
Westinghouse Electric Corporation
  Electronic Systems Group
Williams International
Wyman-Gordon Company